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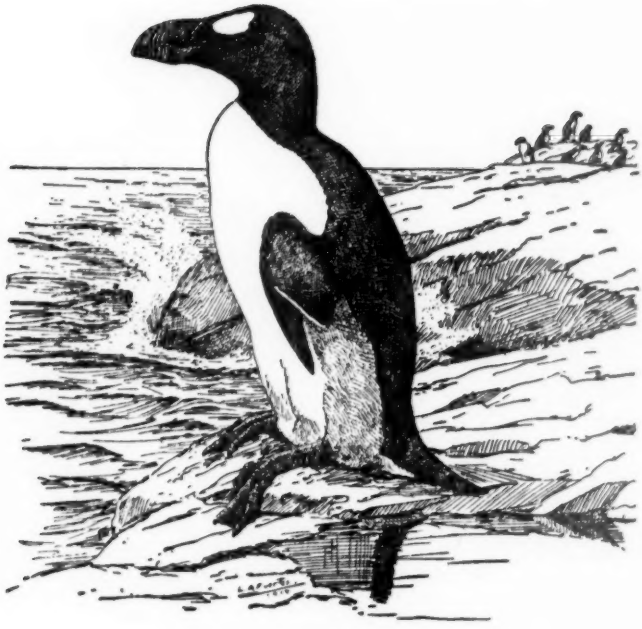

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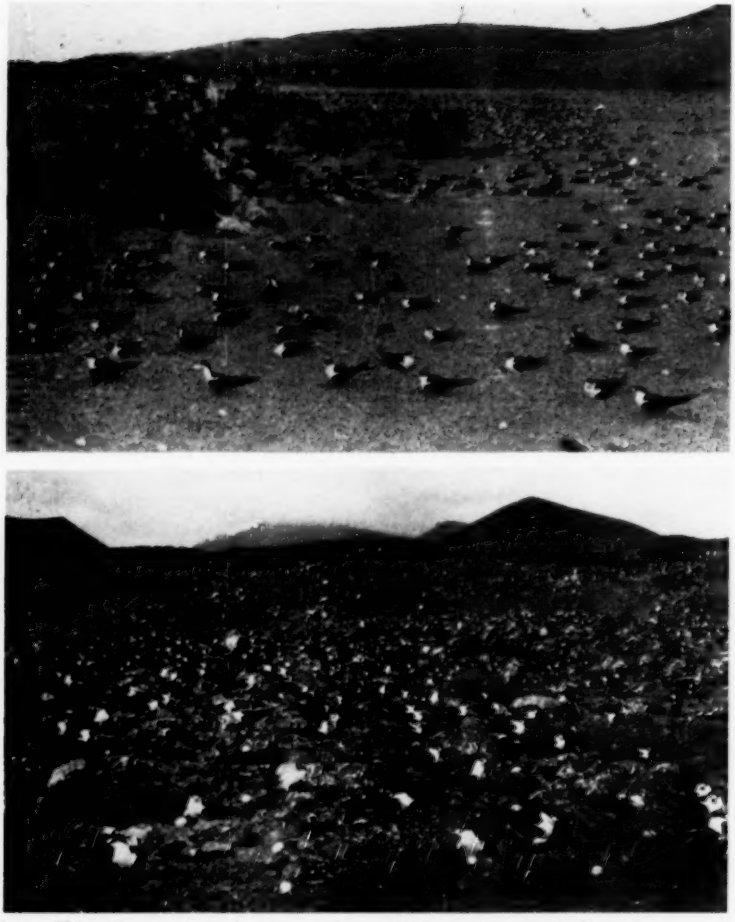

SOOTY TERN COLONIES ON ASCENSION ISLAND, showing two types of terrain occupied.

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THE CALENDAR OF WIDEAWAKE FAIR

BY JAMES P. CHAPIN

Years before I ever saw a Sooty Tern alive I had read, in the volume on birds in the Cambridge Natural History (Evans, 1900:312), a brief reference to the "Wideawake Fair," that celebrated nesting colony of *Sterna fuscata* on Ascension Island described by Collingwood (1867), Sperling (1868), Mrs. Gill (1878: 206–213), Penrose (1879), and many others since then. Little could I have foreseen that one day I might have to make a serious decision affecting the fate of that vast bird society, or that for ten years thereafter I should be so deeply concerned with its doings and its welfare.

During the first half of 1942, an American air-base was being constructed on the southwest corner of Ascension Island, with a broad runway extending right down into the valley where the Wideawakes were most thickly concentrated during their nesting periods. By the time this construction approached completion, the terns had all left the island, then around the last week in July they began to reassemble in numbers. At first they came in flocks toward nightfall to roost on the sand and lava near the southeast end of the air-strip. Soon thousands remained all day, and by August 20 they were laying their eggs. Our aviators for weeks had regarded them as a menace, because clouds of birds rose in the path of each airplane taking off from the runway.

Rather drastic measures were taken to move thousands of the terns to safer areas a little farther from the air-strip. There were of course a number of other well-populated colonies on the same corner of the island, but those did not interfere with military operations. It was clear that the preservation of the adult breeding stock was far more important than their first eggs of the season. Some 40,000 or 45,000 eggs were accordingly broken in the bottom of the valley, close to the far end of the runway; and after ten days scarcely a bird would be

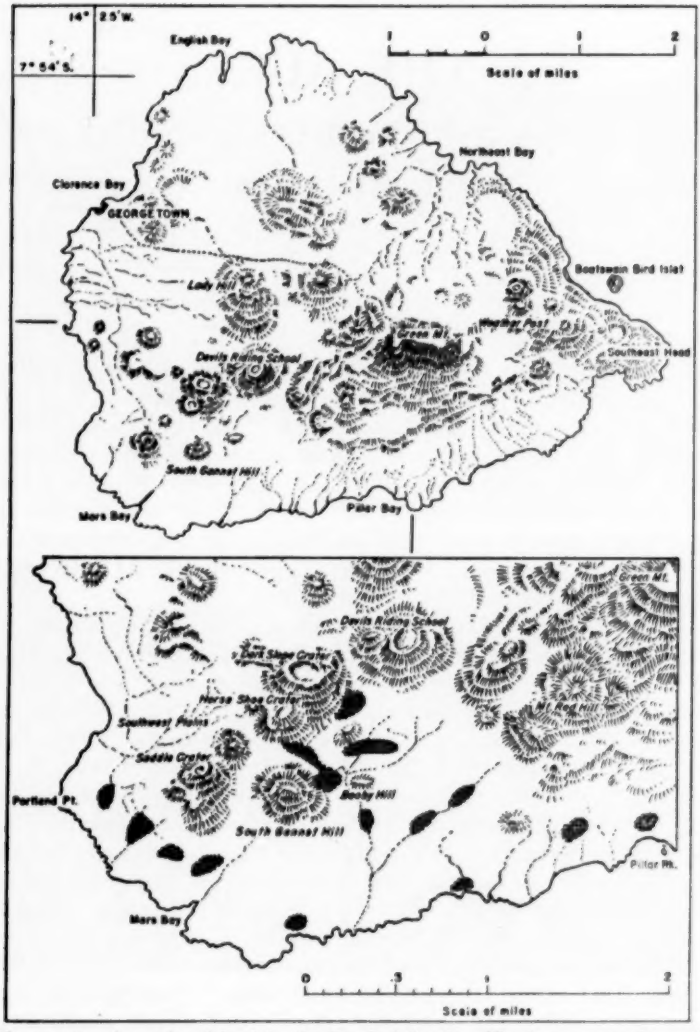

FIGURE 1. Ascension Island in the South Atlantic. The lower map shows the southwestern part of the island; the crosshatched areas are those occupied by nesting colonies of Sooty Terns between 1942 and 1946.

seen alighting in that area. I had good reason to suppose that they would lay again elsewhere that same season; indeed it might mean only a delay of a few weeks in bringing off a nearly normal number of young.

But the same problem was likely to arise periodically as long as Wideawake Air Field continued in operation, so before the end of my month's stay on Ascension I recommended that each time the Sooty Terns attempted to reoccupy the area close to the air-strip their eggs should all be taken while still fresh. They could then be used for food, and the birds should move away. But from what I heard during the next few years it seemed that my advice was not always followed to the letter. In 1943, when laying began in mid-May, it was reported that some 23,000 eggs were collected by our Quartermaster's men, and many others by the residents of the island. But there were times when hundreds of dead terns were noted by other visitors; some shooting evidently went on.

After the war ended, however, I was gratified to hear from Colonel J. Noel Tomlinson, representing on Ascension His Majesty's Government of St. Helena, that in his opinion the total population of Wideawakes had not diminished during our occupation. After several years on the island, he had not yet been able to decide whether they might number one million or perhaps two. It is my belief that in 1942 there may possibly have been a million.

Ever since the British Navy first occupied Ascension Island in 1815, numbers of eggs have probably been taken each time laying began; they are very good to eat, and supposedly the first eggs are quickly replaced. Before long it became evident that the interval between successive layings was shorter than twelve months. At first it was commonly said, as by Penrose in 1879, that the period was of 8 or 9 months, and for the next 60 years no one seemed to keep any accurate record. Various scientific missions stopped at Ascension; they often published their observations on the Wideawakes, if these birds happened to be breeding. Those random observations could scarcely be arranged in such a way as to reveal the average length of the breeding cycle. British naval personnel and employees of the cable station have often remained many years at Ascension, but I was unable to find that any accurate consecutive notes had been compiled before 1942. Dr. Robert Cushman Murphy (1936: 1120–1132) had concluded that the reproductive cycle on Ascension must require close to 9 months, so that 4 nestings might be expected every three years. It was evident that the Wideawakes were not governed by our 12-month Gregorian calendar.

Although I could not expect any opportunity to revisit the island after my own stay there from September 5 to October 5 in 1942, I resolved to keep in touch with men on Ascension who would tell me of the beginning of each successive nesting period. For more than 30 years, I had been concerned with the reproductive seasons of birds in equatorial Africa. Here was a most unusual situation; even though Ascension lies almost eight degrees south of the equator, it might offer an illuminating comparison.

Luckily I made the acquaintance of several men who might be expected to remain on Ascension for some time. Among them were Colonel J. Noel Tomlinson, mentioned above, also Thomas Dodge and Glen Addison-Williamson, both representing Cable and Wireless Ltd. which has an important installation there. Several officers of our Air Force very kindly provided me with all the ornithological information they could, but they were not apt to stay very long on the island. Other friends who called there in the course of Atlantic crossings were sometimes able to fill in gaps.

Thomas Dodge had spent some years on Ascension; in 1942 he was harbor master and farm superintendent. He was concerned, as was I, over the fate of the Wideawake Fair. He recalled that in the latter part of 1941 the Sooty Terns had begun laying some time in the first half of November. He was positive that very early in that same year there had been another breeding period, but could not be certain that the first eggs were laid in January, as I now feel justified in assuming. If the interval were exactly 9 months, another year with two layings would be expected in 1944.

During 1943 and 1944, it was Dodge who provided my best information. The last few terns of the 1942 convocation left around January 24, 1943. New arrivals made their appearance about April 7. On April 24, no eggs could be found, but laying had begun in earnest by May 15. From the date of the first eggs, one may usually count about five to five and a half months as the normal length of continued sojourn.

In 1944 the Wideawakes reappeared around January 17 and began to lay eggs March 1. Such persecution as they suffered did not delay the normal course of events, for they left the island with their young after the usual five months. Indeed in the second half of November, 1944, they were once more heard calling as they flew over at night. That is usually the first announcement of the return. By the end of December the birds were settling in numbers near the runway, but no eggs had yet been laid. It was evident now that their cycle exceeded 9 months.

SOOTY TERNS ON ASCENSION. *(Above)* A chick has strayed beyond its territory, causing a quarrel between two parent birds. *(Below)* Result of the quarrel, the chick at left has been pecked on the head by one of the parent birds and lies dead.

Dodge had by this time been transferred to a cable station in the Orient. It was fortunate that Lieutenant D. C. Alexander at this time was stationed on the island; he informed me that the first egg was noted on January 3, 1945, and that some few were still being incubated as late as April 22, when he left Ascension. What happens to chicks hatched from such late eggs is not clear, for presumably the nesting grounds were deserted by early June. Three different informants reported that after the customary absence, the Wideawakes returned again by September 1, and possibly even a few days earlier. Colonel Tomlinson felt this time that egg-laying was noticeably delayed. He saw his first eggs, 30 of them, on November 6, 1945; but Major L. E. Buckley reported a few eggs as early as November 1. In any case, this was the first year since 1941 with two actual layings; and the average interval now appeared to be 9.3 months.

It must be remembered, of course, that my informants were not able to go over the ground every day, and while they usually looked for eggs near the air-strip or along the south coast not very far away, there was always a possibility of the very first eggs being overlooked. Furthermore, as I believe I proved in 1942, the first eggs in some colonies hatch at least a week earlier than in others; there may be an even greater deviation in initial laying between separate groups. On the whole, nevertheless, all the Wideawakes on the entire southwest side of Ascension come and go as a body, and the average dates over a sufficient period of years are of real importance.

Wideawake Field was still in operation, and I was determined to get a record of successive breeding seasons as long as I possibly could. Colonel Tomlinson and I kept up our correspondence until he went back to England late in 1946. The second convocation of 1945 held on into the next year, and I was informed that the last stragglers disappeared some time in the last week of May, 1946. This time the birds stayed away at sea for little more than two months; they were certainly noticed again in the first week of August, 1946. The first eggs were noted by Colonel Tomlinson on August 19, yet others were still to be seen as late as November 12. It is clear that early losses are commonly made good, and we must doubt that a second egg is normally laid after the first chick has been successfully reared and has learned to fly.

By mid-March of 1947 most or all of the terns had departed, but on June 4 they were heard again by Glen Williamson, who now became my faithful reporter. There were eggs again by June 18 or 19, and some young seemed still not quite able to fly on November 17. Yet all had left Ascension by November 28, 1947. In 1948 the Wide-

awakes were heard again on March 7; eggs were taken on April 11, but laying was thought to have begun by April 4. On August 9 many young were still unable to fly, all quit the island by the first week of October, and the returning travelers were heard again on December 25.

In 1949 the first eggs were seen on January 21. On June 5 the young were still not all strong fliers; presumably all left by early July. Again there was to be a second laying within the year, but Williamson left in October for a long vacation in Australia. Fortunately he asked Arthur Wood to keep watch on the birds for him. Wood later reported that eggs were first laid, as expected, during the first week of November. By now it had become clear that the average interval was a little longer than I had thought in 1946.

In 1950, according to Wood, the birds remained about Ascension till some time in April. I had expected them to begin laying in this year about August 20; but the first eggs were actually found, according to Williamson, on September 5. That this was correct is rendered nearly certain by the date of the first eggs in 1951, June 26 as reported by Williamson. In 1952 this same informant noted April 25 as the date when the first egg was found. This is a trifle later than I should have expected, since it is 304 days (approximately 10 months) after date the received for 1951.

It might seem more precise to record each period in days, but in view of the rather casual method of obtaining the dates this would be a needless refinement. Our records appear to show a variation between 268 and 307 days, which may or may not be correct. From August 1942 to April 1952 the average interval is close to 292.6 days, or 9.61 months. The most useful figure at present will be 9.6 months, and the way in which laying recommenced toward early November of 1941, 1945, and 1949 is good confirmation.

The difficulty of continuing the calendar back through the years before 1941 has been mentioned. If the cycle was exactly 9.6 months, then the years in which laying began twice were 1937, 1933, 1929, and 1925. For 1937 and 1933 I can find no observations. But in 1929 J. W. Feiss visited the Wideawake Fair on June 9 or 10. He saw no eggs, only young well past the downy stage; so the Wideawakes were soon to leave their breeding grounds, as would be expected if eggs had been laid around January or February, and were due to be laid again before the end of the year. Then in 1930 there should have been a laying toward August or September. This agrees well with the observation by R. E. Moreau (1931) of great numbers of Wideawakes flying out from the northern point of Ascension Island on October 1, 1930.

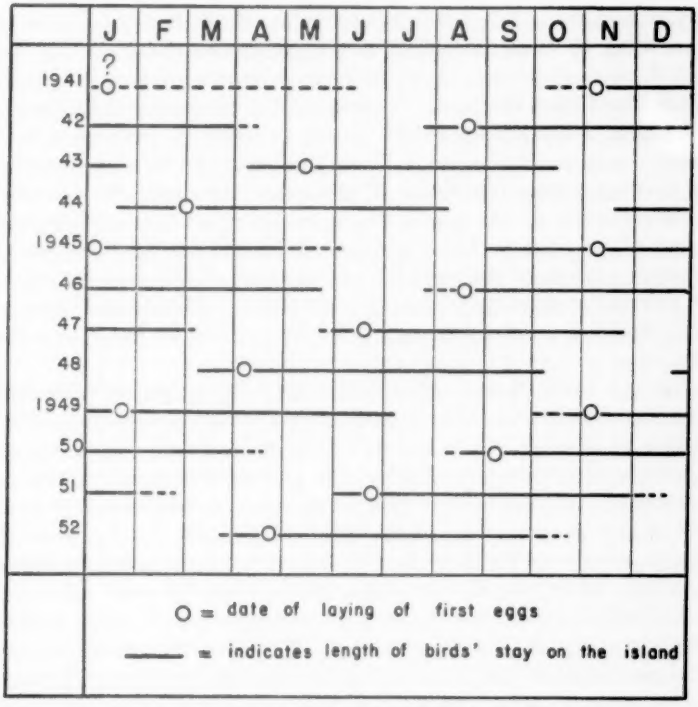

FIGURE 2. The calendar of Wideawake Fair, 1941 to 1952.

The year 1925 was very likely another year with two layings. The first eggs were certainly laid by November 20, when two were collected by members of the Discovery Expedition. These are in the British Museum. The Blossom Expedition visited the Wideawake Fair between December 8 and 15, 1925, and found many eggs. So there may have been another laying very early in 1925.

A note by Huckle (1924) here introduces an element of doubt. If his observations were made early in that same year, and many eggs were destroyed by heavy rains in February and March, then the year 1924, instead of 1925, may have been the year with two layings. This view is strengthened by the note of G. H. Wilkins (1923:510), who reported that on August 3, 1922, most of the eggs at the Wideawake Fair had already hatched. In that year laying must have begun before the end of June; and in 1923 the starting date would have been around April.

Now that we have records as precise as can be hoped for from the years 1942 to 1952, inclusive, and approximate dates for the year 1941, I feel that it is time to publish this interesting calendar. It may be explained that the black horizontal lines are intended to show, in so far as it is known, the length of stay of the Wideawakes at Ascension for each nesting period. A small circle marks the date on which the first eggs were reported. This record refers only to the southwestern section of the island, for in recent years there has been no report of any Sooty Terns nesting on Boatswain Bird Islet or the adjacent portion of the main island. In view of the way tern chicks are gobbled up by frigate birds, I deem it very unlikely that the terns could breed successfully anywhere in the vicinity of Boatswain Bird Islet.

The old navigation charts indicate that the principal Wideawake Fair was once on the wide Donkey Plain, much closer to the Cable Station at Georgetown than the Waterloo Plain and the valley into which the air-strip runs. Within the past twenty years, however, it is reasonably certain that no Wideawakes have bred there; and it may well be that the proximity of the town and the continued gathering of eggs near it forced the terns to withdraw toward the south for greater security. It is possible, too, that the population may have been considerably reduced during the past half-century, although I cannot offer any evidence of such reduction. Now that the airport has been little used since 1947 it may be hoped that their numbers will be kept up, or perhaps slowly augmented. Feral cats, which appear to be quite numerous, are probably their worst enemies; these account for numbers of dead adults found on the nesting grounds, with only the breast-muscles eaten away.

The departure of the old and young Wideawakes at the end of each breeding period is stated to be rather abrupt, even though there may have been a previous diminution in numbers; but not often is the final date of departure recorded accurately. The average period of absence is evidently from 2½ to 3 months. The date of return is much more apt to be noted with fair exactness, for then the birds come flying about noisily at night, even over Georgetown, and thus are very apt to attract attention. Close to their nests the birds' voices may sound rather disagreeable and squawky, but a flock high in the air produces a more ringing chorus, which to my ears at least is all but bell-like and very pleasing.

More than one competent authority has said that the situation on Ascension, with regard to the reproductive cycle of the Sooty Tern, is unique. It certainly is utterly different from that prevailing at the

Dry Tortugas in latitude 24° 37′ north, where the terns appear to belong to the same subspecies, *Sterna fuscata fuscata*. In early May, 1930, I watched those terns on Bird Key just after their return, before nesting began; they seem bound to a 12-month cycle by seasonal weather conditions prevailing there. Alexander Sprunt tells me that they are frequently heard flying over at night in the second half of February, two months before they begin to alight on their breeding grounds.

I feel of course that the abbreviated cycle on Ascension is not a mere curiosity, but rather an example of something that deserves still closer study elsewhere. About St. Helena, which lies in lat. 15° 50′ south, the Sooty Terns were said by Melliss (1875:98) to return each year toward the end of December so that there too they adhered to a twelve-month cycle. I have done my utmost to verify the statement, and have been assured by several correspondents, in different years, that the nesting season on the islets close to St. Helena comes annually, between October and January. As late as January 27, 1949, very young chicks as well as eggs were noted on George Island, while on that same day on Shore Island there were only unhatched eggs. Yet at some places egg-laying was said to begin in October. In 1952 there were many eggs on some of the islets on November 25, none yet hatched.

In the South Pacific at the southern edge of the range of *Sterna fuscata*, I watched these terns at a nesting colony on Motu Nui, an islet off the southwest corner of Easter Island. There the birds are said to return annually in September, and the presence of some eggs as late as January 17, 1935, may be attributed to continued raiding by the islanders. A few centuries ago their ancestors regarded this as their sacred bird ("manu tara") and each year staged a swimming contest, which was aimed at obtaining the first egg of the season.

During this same cruise of the yacht Zaca, we had noted gatherings of Sooty Terns on rocky islets off Nukuhiva in the Marquesas around October 8, and later on we visited the island of San Felix off the coast of Chile, finding a colony of the same species with young mostly on the wing by February 18, 1935. Their first eggs must have been laid by November. It is clear that in both northern and southern hemispheres, wherever there is any marked change from winter to summer, one period of egg-laying is the rule, and it comes in springtime.

In view of what I learned at Ascension in 1942, I could not help wondering whether there might not be other islands in the Atlantic, Pacific, or Indian oceans, so situated near the equator that Sooty Terns might return to breed more often than once in 12 months. Ascension

has no summer or winter, no rainy season, and any wind that blows is apt to come from the southeast. Frigate birds and Masked Boobies in very low latitudes often give the impression of nesting through most if not all twelve months of the year. A Sooty Tern colony differs in that its members all gather at the breeding ground at about the same time, courtship takes but a few weeks, and suddenly eggs are produced in great numbers. No doubt many are lost by accident or predation, new eggs are laid, and the rearing of many chicks is retarded. But a stay of four to six months allows time for all that. Eventually the last young take wing, the breeding season is terminated, and the whole population disappears over the ocean.

It is generally agreed that most birds must have a physiological cycle which includes a period of sexual activity and one of relative inactivity during which molt of the plumage, and often migratory movements, may be carried out. For suitable adaptation to the environment in most regions some regulator of that cycle will be essential. It has been proved beyond a doubt that in many cases in the Temperate Zones the increasing duration of daily illumination serves as such a regulator, by stimulating the organs of reproduction—presumably through a gonadotropic hormone. Yet it is perfectly evident that birds living in a narrow equatorial belt where there is no appreciable change of daylight must have their cycles regulated by other influences if they are to have any regular period of reproduction. I have been unable to find any climatic regulator for the Wideawakes of Ascension, so it would seem that their social instincts alone affect their innate physiological rhythm.

On what other islands, one may ask, would similar conditions prevail? The Blossom Expedition, after finding the Wideawakes busily nesting on Ascension in December, 1925, had gone on to Rocas Reef, latitude 3° 52′ South, off the coast of Brazil. There in April of 1926, many Sooty Terns were incubating eggs (Simmons, 1937). It was evident that their nesting season was not synchronized with the one on Ascension, but it would require more than one visit to prove that it did not follow a 12-month rhythm. I wrote to several Brazilian naturalists, and learned only that because there were no residents on Rocas, no record could be provided of successive nesting dates of Sooty Terns there.

My attention was drawn again to the Pacific by a film made by Lowell Thomas in June 1945 on Johnston Island, near latitude 16° 45′ North, in which a colony of Sooty Terns was shown close to the airport. Correspondence with General B. E. Nowland and Captain A. S. Hill of the American Forces revealed that the terns were back again and

nesting in the same month of 1946. There was a hint that some had returned to nest on the same island in November or December. That seemed curious, but no confirmation could be obtained.

From Christmas Island, at about 1° 45′ North latitude, I learned from Major J. T. Carter that thousands of Sooty Terns began nesting in May of 1947 and 1948, while D. K. Bailey who had visited that island in 1946 told me that during the first ten days of July he had seen many eggs of that same tern, some just hatching. But Major Carter further informed me that in the latter part of November, 1947, another nesting period had started, so that there were definitely two seasons of egg-laying, about six months apart.

This was confirmed by Kelvin Nicholson, District Officer in the Line Islands, who wrote me on December 11, 1948, that the Sooty Terns were then laying on Christmas Island, and that they had had eggs in January and June of 1948. The numbers of birds present during the two different seasons were much the same.

It was Nicholson, too, who first told me of a mimeographed report on the birds of Palmyra Island, near 5° 50′ N. lat., which Dr. G. H. Castle prepared in 1944. On Palmyra, Dr. Castle noted, between 50,000 and 100,000 Sooty Terns arrived in mid-May and soon began to lay. After the chicks had been reared the great majority of adults and young left the island, then a few terns came back "for the late fall nesting period. The nesting ground in the late fall is located on a road on Pelican Island"—evidently a somewhat different spot from the one used in May-June.

There cannot be any doubt of the breeding twice in a year by the Sooty Terns in some of the islands in the Central Pacific. Even on the islets of Manana and Moku Manu, off the eastern end of Oahu in the Hawaiian Islands, near latitude 21° 20′ and 21° 25′ North, Richardson and Fisher (1950:293–295) found that Sooty Terns laid eggs and incubated on Manana from April to July and on Moku Manu from about November to March. It would seem impossible that any individual tern could complete a successful nesting and be ready to start over again in six months. Far more likely would be a division of the population into two groups, one group beginning to nest in April, the other in November. Where these Hawaiian birds went in their off season should not make very much difference, since few would seem likely to wander very far south of the equator. Weather conditions at the breeding stations might seem far more likely to provide two optimum periods for nesting. At Christmas Island, too, there might be two seasons of relative dryness, best suited for breeding. On Ascension exceptional spells of heavy rain, usually coming at intervals

of several years, have been said to cause havoc among the nesting Wideawakes. But it need only be said that my search for another equatorial island with a population of terns having a breeding cycle of anything near 9 or 10 months has gone unrewarded.

Let us switch our attention next to conditions on a continent crossed by the equator. Africa will be best, since the breeding seasons of its birds are now beginning to be investigated seriously; and we may be able to make some suggestive comparisons. Regular annual breeding periods are characteristic of birds in tropical savanna regions on both sides of the equator, even to within 3 or 4 degrees of that line. There the seasonal variation in length of daylight is very slight, but a well-marked dry season produces changes in the atmosphere, soil conditions, and vegetation that must surely affect the internal physiologic rhythm of most birds. It is clear that most if not all of them have become adapted to nesting in precise periods of the year, and that while many do so during rainy months, not a few species just as plainly select the dry season.

Close to the equator in western Africa there is usually a broad belt of lowland rain forest, and within its northern and southern borders the dry period of the year lasts for scarcely more than a month or two. This forest ends rather abruptly in the Ituri, Kivu, and Manyema districts near the 29th meridian of East longitude. Farther east, in Uganda and Kenya Colony, forests are of small size; the annual precipitation is considerably reduced. Along the equator there, two dry spells normally come in each year, and two wetter periods, the "long" and the "short" rains.

At the northern and southern edges of the Cameroon-Congo forest the dry periods come at opposite months in the year. Across its central area, as might be expected, stretches a band where the rains vary but little throughout the year, and length of daylight not at all. Here the birds are adapted to a perpetual rainy season; and of many species, as pointed out by Bates (1908) and Chapin (1932:301–321), nests are to be found in every month of the year.

In the northeastern Congo, on the other hand, at 4 degrees north of the equator, the common Village Weaver-bird (*Textor cucullatus*) will cease nesting from December to April; and in the Kasai District at 5 degrees south, its off-season lasts from June to October. Close to the equator there is no month when active colonies of this weaver are not to be seen in clearings near villages. We can scarcely assume that the individual birds have 12-month reproductive cycles. The lack of external regulators almost certainly permits them to join or desert the colony at any time. My own feeling is that the internal rhythm may

SOOTY TERNS ON ASCENSION. (*Above*) Chapin being "threatened" by a tern. (*Below*) Close-up of two adults in the threat posture.

be less than 12 months, and here the birds need not wait for rains or new green foliage.

Back in the shade of the rain forest, conditions remain even more uniform. As Bates first pointed out, the males of a paradise flycatcher and a fruit pigeon appear to retain enlarged gonads throughout life. Their nests may be found in any month. North and south of the equatorial forest, these same species have representatives with a definite breeding cycle. But even in those drier regions it might be advantageous if the internal rhythm tended to be slightly shorter than twelve months. Any individual bird would be ready for breeding just as soon as the weather or vegetation became favorable.

Nevertheless there is one environmental factor, even directly on the equator, which clearly regulates the breeding time of certain birds. Large rivers fall periodically, exposing sandbars where skimmers (*Rynchops*), lapwings (*Xiphidiopterus*), pratincoles (*Galachrysia*), River Martins (*Pseudochelidon*), and other birds nest. Such birds cannot nest when a river is in flood. The Congo River has two periods of low water annually, but the River Martin nests only once a year. Some of the others may breed twice.

In Uganda and the adjacent parts of Kenya Colony, prolonged study of nesting seasons by Jackson (1938), van Someren (1916), van Someren and van Someren (1949), and Belcher (1919) has shown that many insectivorous birds tend to have two separate periods of reproductive activity in the year. Drier weather seems to inhibit their nesting, but just when they go through the molt is not clear.

Thus in equatorial Africa there are some birds that nest at two different seasons of the year, like the Sooty Terns on some Pacific Islands, and others relieved of external regulators that nest in any month. The latter might be compared to the Wideawakes of Ascension, but they lack the strong social bond that causes the Wideawakes to reassemble in a body.

Great progress has now been made, by close observation and controlled experiment, in the study of breeding cycles of birds in the Temperate Zones. But a start has barely been made in the investigation of corresponding conditions in rainy areas on the equator, where length of daylight remains uniform the year round and seasonal variation of weather is negligible.

SUMMARY

Records compiled over a period of eleven years prove that Sooty Terns on Ascension Island assemble to begin nesting at average intervals of 9.6 months. Thus instead of nesting four times in every period

of three years, as has often been said, they begin to nest five times in every four-year period.

The reason for this unusual cycle of reproduction appears to be the lack of any marked seasonal change in the weather at Ascension Island, and the pronounced social bond between the members of a Sooty Tern population. Relieved of any seasonal hindrance, it must be supposed, they follow an internal rhythm.

A search for some other island where terns behave in like fashion has not yet succeeded. But on some islands in the central Pacific, from Christmas Island north to the vicinity of Oahu, Sooty Terns are now known to have two distinct breeding seasons in each year.

It is recommended that further study be given to breeding seasons of the many birds resident in rainy equatorial belts around the world, where seasons are virtually lacking and change in the length of daylight is at its minimum. If definite breeding periods can be found there, what environmental factors regulate them? If no definite breeding seasons exist, what is the physiological rhythm of the individual, and how is it adjusted to pair-formation and the perpetuation of the species?

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TERRITORY, NEST BUILDING, AND PAIR FORMATION IN THE CLIFF SWALLOW

BY JOHN T. EMLEN, JR.

COLONIAL nesting is a rather rare phenomenon among passerine birds, and there are few species in which it is more highly developed than the Cliff Swallow (*Petrochelidon pyrrhonota*). The social behavior of these birds as studied at a series of colonies in northwestern Wyoming in the summer of 1950 has been described in an earlier paper (Emlen, 1952). The present paper is concerned with problems of pair formation and related activities at the nesting site. It is based on observations made at the same colonies in Wyoming in 1950 and 1951, with supplementary data obtained at three colonies in southern Wisconsin in 1952.

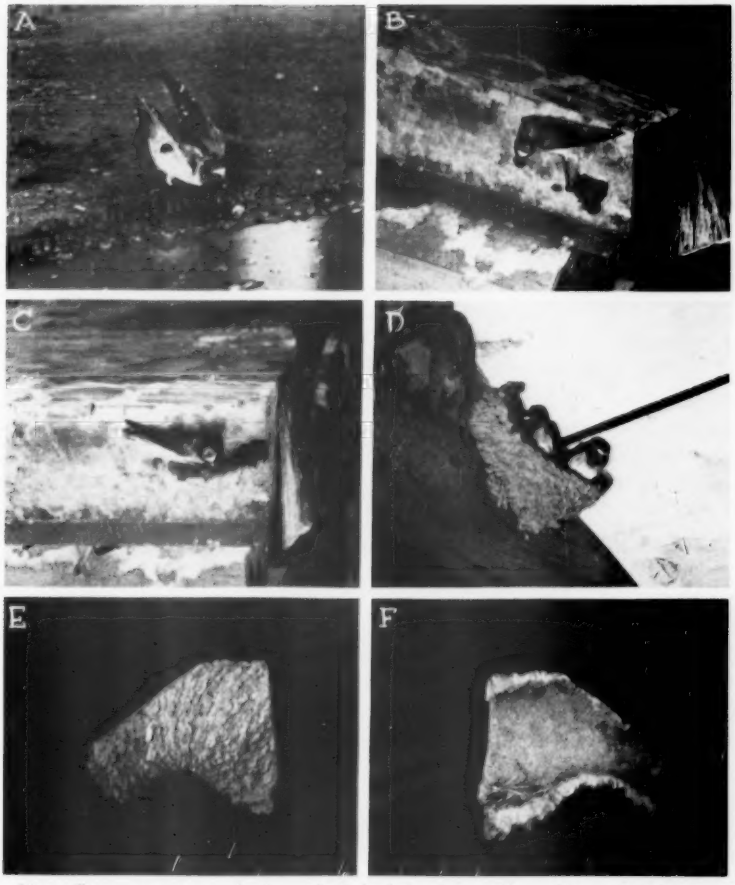
The main part of the work was done at the Jackson Hole Research Station of the New York Zoological Society at Moran, Wyoming, under a grant from the Society. Special thanks are due to the Society and particularly to the director of the Research Station, Mr. James Simon. I also wish to thank Mr. Robert Nero and Mr. Arnold Petersen for their helpful suggestions and criticisms of the manuscript.

MATERIALS AND METHODS

Observations were made with a 7 × 50 coated binocular. Large aluminum foil reflectors, 3 feet × 4 feet, were used extensively for illuminating heavily shaded colony sites and nest interiors, both for observation and for photography. Simple tent blinds were used in a few situations but were found to be unnecessary in most places. Many observations were made from a parked car.

Birds were marked for individual recognition by spraying them with fast-drying lacquer shot from a metal water pistol. By using this technique at the mud-gathering sites it was possible to mark birds at the very start of nest building. The random pattern of paint drops on the plumage (plate 4, A) was noted and recorded subsequently as the birds were being observed in their nesting activities. With about thirty birds so marked in two colors, no problems of confusion through duplication of markings arose. The lacquer on the wings and tail held up well through the breeding season; that on the body feathers was less permanent and occasionally caused bothersome clumping of the feathers.

Birds with completed or nearly complete nests were marked by suspending bits of string or small brushes dipped in enamel from the top of the nest openings. Most of the birds on entering thus received



NEST CONSTRUCTION. *A*. A marked (paint splattered) swallow collecting mud for nest building. *B*. Typical posture used in applying first mud pellets about 4½ inches below the overhang. *C*. Horizontal posture assumed in nest building after initial ledge (stage I) has been completed. *D*. Placing mud on rim from position in nest cup in stage IV nest. *E*. Whole nest (stage VI) removed to show shape and structure. The angle of the top was determined by the slope of the roof under which this nest was built. Note the alignment of mud pellets in "growth rings." *F*. Median sagittal section of the same nest showing thickness of the shell, texture of the inner wall, and extent of nest lining.

a colored band or line across the white forehead. Color and chance variations in the width and form of this band served to identify individual birds as they stood in the nest entrance. Aluminum bands, presumably those placed on birds during the 1950 studies, served as additional markers on five birds observed for pairing behavior in 1951. Natural variations in plumage pattern and color supplemented these artificial markings and served to identify a number of birds which were never painted.

All behavior notes were made on the spot and each action described as it was performed. Observations were accordingly interrupted for note taking in preference to reliance on memory for more than a fraction of a minute. This procedure proved to be highly important in the fast action which often took place at the nest sites.

THE NESTING SITE

The essential features of the nesting habitat of the Cliff Swallow appear to be 1) an open foraging area, 2) a vertical substrate with an overhang for nest attachment, and 3) a supply of mud suitable for nest construction. All of these features must be contained within an area encompassed by the foraging range of the nesting birds.

The Foraging Range.—Foraging ranges at three colonies extended to two, two and one-half, and four miles, respectively, from the nesting sites. Colony membership could not be determined for most of the birds over the foraging range, but a nearly constant flow of individuals flying out from or back toward the nesting site showed the identity of the flock as a whole. The cruising speed of these birds over the inward or outward course was, in the absence of strong winds, about 100 yards in 10 seconds. A bird would thus require only from three to six minutes to reach an outpost in the foraging range. The extent of the range during pair formation and nest building was nearly if not just as great as in the period when food was being collected for the nestlings. During nest building and egg laying, however, the birds were more coordinated in their activities and visited outlying points in the range only at infrequent and irregular intervals. Later, the birds were less coordinated and tended to scatter or disperse in smaller subgroupings.

The shapes of the foraging areas were determined largely by topography and the distribution of grass and sedge meadows and, as a result, were highly irregular in shape. Intervening hills and wooded areas were generally circumvented where this was possible, but low sage-covered hills were frequently crossed and even used to a limited extent for foraging. Open water was no barrier, and shore lines were

favored as foraging areas. On several occasions the birds were encountered more than half a mile from shore over Jackson Lake. Flocks tended to circle high during mid-day and before storms, and at such times often drifted over the borders of timbered areas.

The Nesting Substrate.—A variety of sites were used for nesting (plate 5). Of eighteen colonies observed in the Jackson Hole area, eight were under the eaves of buildings, four were under concrete culverts, three were under ledges in large concrete bridges or dams, one was on steel girders under a steel-wood bridge, one was on a natural limestone cliff, and one was on a sand bank. All of the three colonies under study in Wisconsin were on buildings. In all cases, the essential features of the site seemed to be: a) a vertical surface beneath a ledge or overhang and b) clearance below of at least three feet if over water and eight feet if over land. Almost any site possessing these features was explored by hovering flocks of swallows at the beginning of the nesting season. Sites used in previous years commonly had many old nests remaining in good condition, and these were quickly adopted. In other situations, the birds would alight and cluster wherever ledges, slight irregularities, or remnants of old nests provided toe holds. In one place where the birds were unable to secure a perch, the placement of narrow board strips five inches below the overhanging eave resulted in the prompt establishment of a nesting group. Low sites and sites without a protecting overhang seemed to hold no attractions for these hovering flocks. The first nests built at a site were located at the juncture of the vertical wall and the overhang, and if under a sloping eave of a roof, at the highest point or peak. Later builders would frequently utilize completed or partially built nests for either the vertical or the horizontal attachment surfaces. Nests would thus accumulate in masses, the colony extending downward under the primary series or horizontally outward under the overhang (plate 5, C). Nests built below the primary series were characteristically placed between two overlying nests, possibly as a response to the tendency to locate beneath a peak. Nests built outward on the horizontal overhang were most often placed at the end of the primary nest where the surface presented a vertical base. Occupants of the primary nests in such cases often extended their entrances downward to form a nearly vertical entrance tunnel. Old nests were used repeatedly in successive years until they fell into decay. In one obviously old colony, the primary nests at the juncture point persisted only as irregular broken walls of mud, largely untenable.

The height requirement of about eight feet over level ground was a valuable protection against predators, which could have made short

work of a breeding colony situated within their reach. Signs of predators were detected under several colonies. At Uhl Hill, where coyote signs were numerous, none of the 152 nests was within my reach when I wished to check nest contents.

Colonies situated over water did not show this height characteristic, and nests were often located within easy reach of an observer in a boat or wading. The apparent height requirement of at least three feet above the water level in such situations may be related to physical problems encountered by the birds in hovering and landing. In one colony where the birds were nesting under the eaves of a long shed, the nests were largely concentrated over two open doorways. The significance of this selection was not apparent.

Unusual Nesting Sites and Situations.—Some of the various types of nesting sites encountered are pictured in plate 6. Of these, the case of the nests located on a sand bank in a colony of Bank Swallows (*Riparia riparia*) (plate 5, D) appears to be unusual and of rather special interest. Finding an overhanging bank filling the basic requirements for a nesting site, these birds apparently had settled and started to build at the points where they could secure a toe-hold, viz., the entrances to the Bank Swallow burrows. The Cliff Swallows dominated at the burrows they had appropriated and proceeded to build, until complete retorts covered the entrances of the Bank Swallow burrows (plate 6, A). The Bank Swallows succeeded in gaining entrance only when the Cliff Swallows were away and, in several cases at least, finally abandoned the sites leaving their young to starve. No antagonism between the two species could be detected except at the jointly occupied sites, and here it was a clear case of dominance and subordinance, the Bank Swallows rarely challenging the larger Cliff Swallows as they sat in the nest entrances.

Plate 6, B shows a group of nests on a barn, one of which was in the process of being appropriated by a male English Sparrow (*Passer domesticus*). This species was rare in the Jackson Hole area and was encountered only in this colony. Here, as at a colony observed in Wisconsin in May, 1951, English Sparrows were completely dominant over the swallows and readily replaced them in any nest they chose to enter. Birds in neighboring nests showed no particular response to the presence of the intruders.

A pair of Barn Swallows (*Hirundo rustica*) nested in one of the culvert colonies in 1950, apparently appropriating the base of an old Cliff Swallow nest as the starting point. This nest was six feet from the nearest Cliff Swallow nest, and, except for participation in the alarm displays when I entered the culvert, the birds apparently

remained quite independent of the Cliff Swallows which surrounded them. By contrast, a pair of Tree Swallows (*Iridoprocne bicolor*) feeding young in a nest thirty feet from an active colony in July, 1951, repeatedly attacked and chased the larger but less agile Cliff Swallows.

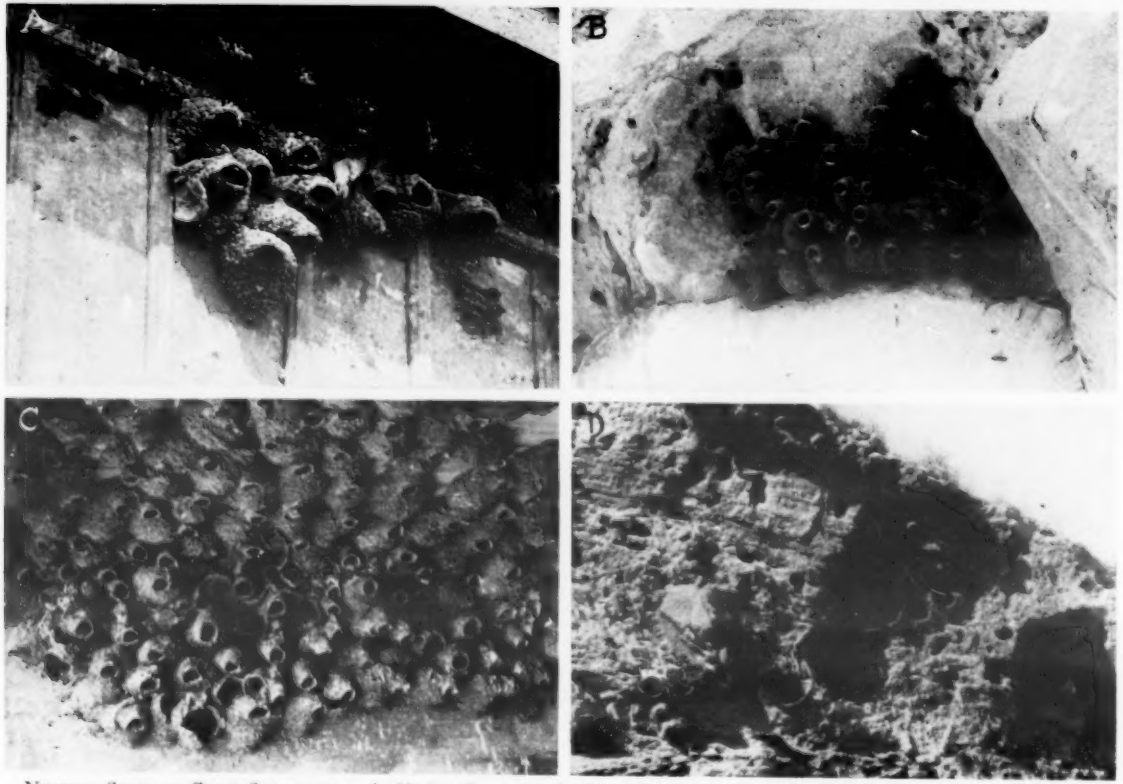
Nesting Materials.—Mud for nest construction was gathered at sites from twenty feet to at least one-half mile from the nesting colony. After rains, almost any puddles close to the nests were utilized, but at other times the birds went farther afield. The availability of mud thus affected the rate of construction. Mud collecting was an intermittent activity in which nearly all members of a flock participated as a group. One or two birds would start the activity by descending to a particular mud site, others would follow, and soon the entire flock would be gathering mud and carrying it back to their nests. At Moran, where members of five subcolonies commonly foraged as a group, the individuals from the more remote subcolonies persistently returned to the mud site selected by the combined flock, even though this meant travelling long distances and passing numerous good sources of mud en route. For instance, birds from one subcolony established late in the 1951 season at a point half a mile east of Moran, started by bringing their mud all the way from Moran. Later they adopted a local source of supply, and their foraging associates from the Moran subcolonies had a turn at traversing the half-mile span.

At the mud sources, the birds typically circled for several minutes, hesitating repeatedly over the site. As soon as one had landed, others followed, and within ten or twenty seconds, up to twenty or thirty birds might be clustered on the wet mud, each working independently with wings partly or fully extended over the back and fluttering lightly. Mud was gathered by a series of vigorous jabs until a large bill-full had been amassed, when the bird would take off and head directly for its nest.

The quality of the mud varied considerably from colony to colony according to local conditions. Nests in some colonies contained much sandy silt and were clearly more friable than nests in other colonies. Several types of mud were often found in a single nest indicating that various sources had been utilized in its construction.

Nests built too rapidly or in humid weather often collapsed before they were completed. In early August of 1951, a prolonged wet spell resulted in the crumbling of many nests which had stood for over a month and contained advanced young nearly ready to fledge.

Dried grass for the nest lining was commonly collected near the nesting site. Transporting of grass from distant sites was not noted but might have occurred undetected. The collecting of this material



NESTING SITES OF CLIFF SWALLOWS. *A*. Under the eaves of a barn, Deerfield, Wisconsin *B*. On a limestone cliff, Moran, Wyoming. *C*. Under a concrete culvert, Yellowstone Park, Wyoming. *D*. On a dirt bank, superimposed on a Bank Swallow colony, Yellowstone Park, Wyoming.

was, as with the mud, a social activity in which many birds from a flock participated as a group. The period of greatest grass gathering activity was in the early morning before mud gathering had started.

FORM AND CONSTRUCTION OF THE NEST

Form of the Nest.—The form of the typical nest shell of the Cliff Swallow is depicted in plate 4, E and F. It consists of a globular nesting chamber extended forward into a short tubular entrance tunnel with the mouth directed downward. Dimensions of 15 sample nests varied from 5.5 to 10.5 (mean, 7.7) inches in overall length and from 5.5 to 8 (mean, 6.3) inches in basal width. The opening in completed nests was from 1.3 to 2.0 (mean, 1.7) inches in height and from 1.5 to 2.7 (mean, 2.0) inches wide. The height at the back (outside measurement) was almost invariably between 4 and 4.5 inches. The thickness of the floor and side walls varied from 0.24 inches in depressions between protruding pellets to 0.66 inches at the centers of large pellets and averaged about 0.44 inches. Walls were slightly thinner toward the roof and entrance. Two average-sized nests weighed 578 and 816 grams when thoroughly dry.

Variations in size and shape were due in part to the nature of the site and to the fact that many birds never completed the entrance tunnels of their nests. The typical nest placed close under an overhanging ledge had no mud roof while the occasional nest placed in the clear (see plate 6, A) was completely roofed. Nests placed in natural crevices at the Uhl Hill cliff had nothing more than short projections of mud extending and narrowing the natural entrance opening (plate 6, D).

The nest proper (or nest lining) was a sparse collection of fine grasses with occasionally a few sticks, hairs, and feathers. Many nests were nearly devoid of any such materials, a few had considerable amounts, but never as much as is commonly found in nests of the Barn Swallow.

Reoccupation of Old Nests.—Nests built in sheltered places generally stood essentially undamaged from year to year and were used repeatedly by the birds. Good nests were used as they were found; partially broken nests were rebuilt. Breaks in the walls or entrance tunnels were neatly repaired so that it was often difficult to distinguish between old and new construction after the mud had dried. Holes in the floor, however, were sometimes overlooked or only crudely covered with nesting material. Three reoccupied nests at the Elk Antler colony in Yellowstone Park had eggs partly protruding through holes in the floor. Small holes experimentally drilled through the floors of two

nests containing young were never repaired whereas similar holes in the walls and entrance tunnel were neatly patched from the inside.

Old broken nests were occasionally occupied and rebuilt. In one such nest, which had a large break in the side, the occupants built a new entrance tunnel at the site of the break and nearly closed the old entrance by additions of mud from the inside. Several nests were found with two complete tunnels and openings. While the history of these nests was not known, their structure in two cases suggested that they were broken nests which had been rebuilt in this peculiar form. In a third case (plate 6, C), the even structure suggested complete new construction along atypical lines.

Nest Construction.—As noted by Buss (1942) nest construction must proceed at a relatively slow rate so that each fresh addition may dry and harden to form a firm base for further construction. Nest building as observed in this study required about one week. The work was intermittent; periods of building activity rarely lasted more than two hours and were separated by interruptions of from a half-hour to four or five hours or occasionally several days. The first period each day was often the major one and generally started an hour or two after the sun had risen. During the rest of the day mud packing was intermittent and irregular.

During periods of activity when both members of the pair were participating, pellets were added at the rate of between 0.2 and 2.0 per minute varying with the distance of the mud source. One active pair brought forty-four pellets to their nest in a half-hour, thus adding more than half an inch to its rim. Nests, however, rarely advanced more than an inch and a half in a day and generally required a minimum of a week for completion (average one inch per day). Progress was slowed at the Moran colonies during the drought period of mid-July, 1951, presumably as a result of mud shortage, and many nests built at this time were smaller than average. Mud-packing was also retarded on damp rainy days; it was greatest during sunny weather following rains.

The number of pellets incorporated in a nest is difficult to determine, but between 8 and 12 distinct pellets are usually visible per square inch of outer surface. Additional pellets not visible on the nest surface number about 5 per square inch, bringing the total to approximately 15. On this basis an average nest with 60 to 80 square inches of surface would contain from 900 to 1200 pellets, and one inch of new construction, an average day's work, would contain about 80 pellets at early stages, about 200 at middle stages, and about 120 at late stages of construction.

The progress of construction of new nests can be conveniently divided into seven stages. The attainment of each stage marks a change in the behavior of the birds and is apparently of considerable importance in the onset of copulation and egg laying. These stages are pictured in plate 7 and described below.

Stage I—a narrow line or crescent. Before starting to build, birds cling to the surface at the prospective site and inspect their surroundings. They repeatedly stretch upward to the overhanging ledge, apparently seeking a toe-hold within comfortable reach. The first pellets are placed by a lateral twist of the body at the level of the feet (plate 4, B), almost invariably between 4 and 4½ inches below the sheltering overhang. Subsequent pellets are often scattered rather widely in an irregular line at the same level. By the time the stage is completed, the location is pretty well fixed and the line has become a narrow but solid crescent of mud with the ends turned upward. The males do most or all of this early construction. Dry grass is often brought and dropped loosely on the mud ridge, where, lacking sufficient support, it quickly falls off unless parts are caught in the wet mud and worked into position with new pellets. The grass and straw to be seen in most completed nests are apparently incorporated, for the most part, in this manner, rather than by being brought in with the pellets.

Stage II—a shallow crescent-shaped ledge projecting from 1 to 3 inches. By the time the nest is an inch wide, the birds can rest on it and defend it more effectively against intruders. Upon alighting, the bird characteristically takes a semi-crouched position in the floor of the crescent and reaching laterally or, with a twist of the head, to the front, explores along the rim for a place to affix the pellet (plate 4, C). Pellets are placed on the outer edge and then worked into position with a vibrating inward movement of the head. Placement generally requires twenty or thirty seconds although rearranging of this and other fresh pellets on the rim often prolongs the process to over a minute. The form and curvature of the nest as it advances seems to be determined by the extent of the bird's reach from the crouched building position. The front or outer rim often slopes downward at this stage. Dry grass is commonly brought and dropped into the cup but is generally kicked out within a few minutes.

Stage III—a rounded half-cup projecting 2 to 4 inches. From stage II, construction proceeds by extension and upturning of the lateral and ventral walls to form a broad cup. The birds are now fairly well screened from view when in the interior, and dry grass when brought may remain for some time. The first egg is occasionally laid at this

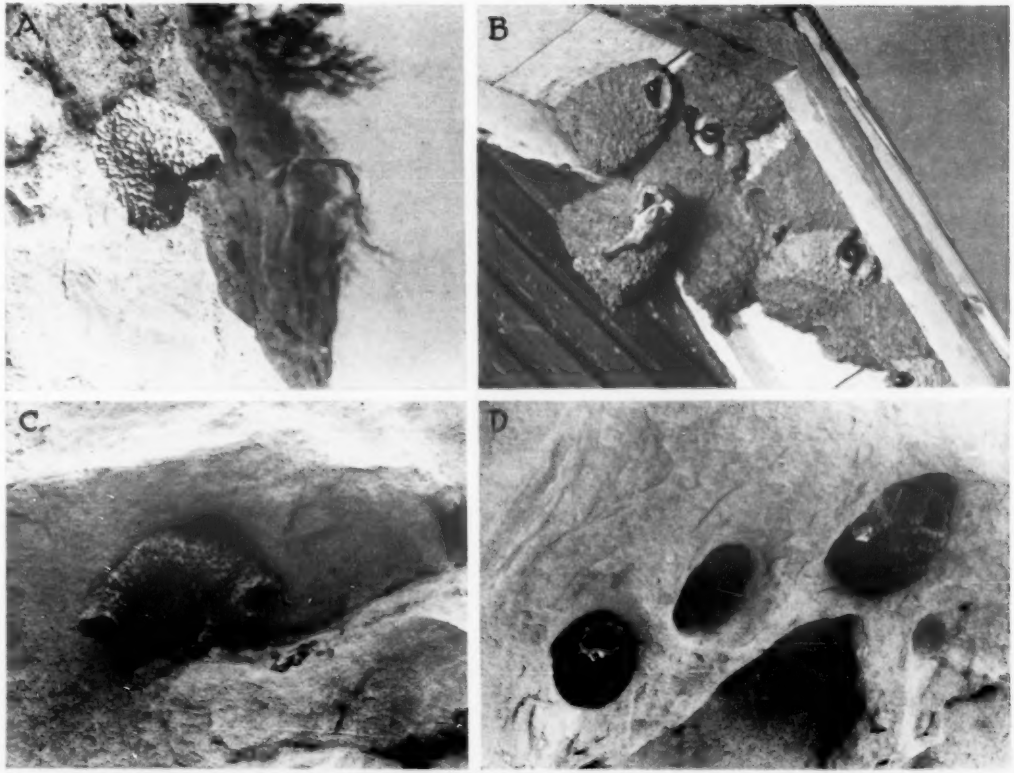
stage, but generally not until later. In building, the birds still perch with their feet in the center, reaching laterally or forward to place their pellets at the rim. This stage and the next are the periods of most rapid nest building.

Stage IV—a bowl with complete side walls projecting 3 to 6 inches. Progress to stage IV involves especially the extension of the lateral walls toward the sheltering overhang above. When the overhang is irregular in form or absent (as in the nest secondarily occupied by the English Sparrow in plate 6, B) the lateral walls are extended upward until they finally meet to form a roof. The forward edge is advanced at a similar rate. Pellets are still placed by reaching from a position with the feet in the bottom of the nest cup (plate 4, D). Nest lining material when brought is now generally retained. Egg laying is commonly started.

Stage V—a wide mouthed retort projecting 4 to 8 inches. From stage IV the walls and floor rim are extended forward and the opening somewhat narrowed. In placing mud the birds enter the nest cup but may then crawl forward to reach the rim which is now leveling off to form a sill. Many nests advance no farther than this stage and thus retain a wide though low-roofed entrance.

Stage VI—a narrow mouthed retort projecting 5 to 10 inches with unroofed entrance tunnel. Nest construction is retarded after stage V. Pellets may be added to the rim, however, extending the ventral lip outward and the lateral edges inward so as to narrow the opening to a circle about 1¼ to 1¾ inches in diameter. The first egg has generally been laid by this time, and varying amounts of nest lining material have accumulated. The birds, now well shielded from intruders except at the small entrance opening, are relatively immune from attack and spend most of their time quietly sitting at the entrance and looking out. The nest shown in plate 8, E and F had progressed no farther than stage VI.

Stage VII—a complete retort projecting 6 to 10 inches, with entrance tunnel. Most nests are completed with the turning down of the ventral lip and the roofing of the opening to form a complete entrance tunnel. The form and direction of this entrance tunnel varies according to the position of the nest in relation to exit and entrance routes and particularly in relation to neighboring nests. Almost without exception, the tunnel is directed away from the nearest neighboring entrance; this may be downward or abruptly to the right or left. The completion of stage VII is generally accomplished after egg laying has started. Nest extension or modification was not noted after incubation had started, although nest repairs, sometimes ex-



UNUSUAL NESTING SITES AND SITUATIONS. *A*. Nest built over the opening of a Bank Swallow tunnel. *B*. Nest being usurped by a House Sparrow. *C*. Nest with two entrances. Fragment below is the remains of an old nest. *D*. Nests in pot-holes in a limestone cliff.

tensive and involving changes in shape, were made at any time until the young fledged.

FORMATION OF THE PAIRING BOND

The process of pair formation was observed *in toto* in four cases and in part in many others. The general procedure can be outlined in a series of steps which follow each other in sequence. On some occasions these steps apparently followed each other in rapid succession and overlapped. On other occasions they developed slowly or were never completed. As observed at Madison, Wisconsin, in the spring of 1952, they started immediately upon the arrival of the birds from the South.

From the beginning, the general behavior of the birds on the nesting area was marked by aggressiveness and intolerance of close association (Emlen 1952). This was seen particularly at the nesting sites. It was also conspicuous in the mixed flocks on the loafing perches and in flying groups as they maneuvered near to or at considerable distances from the nesting site. Flying individuals, particularly those slightly apart from the denser clusters, suddenly broke into a prolonged flight song with throat feathers extended and wings stiffened and fluttering. Immediately all birds within 8 or 10 feet turned and gave chase, driving the singing bird downward until it ceased to sing. Paired and unpaired birds of both sexes took part in these flight songs and chases. The performances appeared to be expressions of excitement, perhaps sexual excitement, but bore no detectable relation to pair formation. All steps of pair formation took place within a small defended territory at the nesting site.

Step 1. Birds hover at colony site. Starting with their arrival on the breeding grounds, non-breeding birds hovered in clusters around prospective nesting sites. Scores of birds would converge and cluster with much singing and fighting, then swerve off and circle for another approach. False approaches were frequent, but as soon as a few individuals succeeded in alighting beneath the overhang, a swarm followed, clinging, often precariously to any available ledges and even to the backs of the first arrivals. A toe-hold secured, the first arrivals assumed a crouched vertical posture with neck drawn in, bill stiffly raised, and wings quivering. Here they sang for twenty or thirty seconds, tensely rigid or occasionally snapping back at one of their aggressive neighbors. Then, either quite suddenly or after a gradual decline in the excitement, the clamor ceased and all birds flew off as a group, with or without the sounding of alarm calls, to circle and again return. The frequent interruptions occasioned by these outflights had

the effect of maintaining a high level of excitement among birds clustering at the site.

Hovering at nest sites occurred most frequently during the two or three hours after sunrise and again during the half-hour preceding sunset, but was observed occasionally throughout the day. It continued from the inception of breeding activity until pioneering nests were nearly completed, and thereafter in lesser amounts as "raiding" behavior (Emlen, 1952: 195). Raiding groups, like the early clustering flocks, were thought to be composed entirely of non-breeders. Marked breeding birds from neighboring colonies were never detected, whereas birds rendered non-breeding by the destruction of their nest in a neighboring colony were seen in the raiding parties on several occasions.

Step 2. Certain individuals persistently return to perch at the same spots. As a flock hovered and clustered at the prospective nesting site, certain individuals, recognized by their paint splatter pattern or by natural variations in plumage, were observed to alight repeatedly within a few inches of the same spot. In one case, this localization was detected during the first five or six visits, and it seems likely that individual site selection typically started within the first few minutes of hovering at a new colony site. Where old nests were present returns were accurately pinpointed; where there were no nests or prominent landmarks, localization was less precise and often extended over a foot or more of space.

In all of three cases where subsequent observations of copulation revealed the sex of the birds, the consistently returning individuals were found to be males. In several other cases, they were strongly suspected of being males. Females also tended to localize their attentions during the early clustering flights, but were apparently slower to alight and less regular in returning to the same spot. Birds which consistently returned to a site in these early clusterings will hereafter be referred to as primary squatters.

Step 3. Singing of primary squatters attracts swarm of secondary visitors. The singing of the primary squatters served to attract a swarm of from 1 to 8 or 10 secondary visitors which hovered over, alighted close by, and even perched on top of them. In contrast with the crouched singing posture of the primary squatter, these secondary visitors perched erect, their heads characteristically turned out, their wings often partially opened so as to cover a part or all of the back of the squatter. In this position they often sang, and, if undisturbed, would enter a sort of song duel with the squatter, turning their heads toward his and lightly pecking his bill (plate 8, B and C). The squatter's typical response after a short delay was a vicious snap, or occasionally, a chase.

The main focus of attraction for these secondary visitors appeared to be the primary squatter rather than the site, but this is not clear, for the visitors commonly alighted in the absence of the squatter. Excitement was clearly centered around the squatter when he was present, however, and the visitors, when they alighted in the squatter's absence, showed little defensive behavior and were easily displaced.

Step 4. Certain secondary visitors repeatedly return to the same primary squatters. With continued observation at a site it became apparent that the same secondary visitors were repeatedly returning to the same primary squatters. During the first few days an established squatter might have 3 or 4 regular visitors plus an indefinite number of irregular visitors. Generally only one visitor appeared at a time, but occasionally they clustered around or above him fighting amongst themselves (plate 8, A).

Step 5. Repetition of visits leads to mutual tolerance (pairing bond). After from one to four or five days, one visitor generally became conspicuous as the consistent repeater at the site. This repetition of visits seemed to lower the level of intolerance between this bird and the primary squatter, fighting subsided, and eventually a relationship of mutual tolerance developed, which was the pairing bond (plate 8, D). Visitors included birds of both sexes and differences between the sexes in behavior or posture were not sharp. In all three cases where a pairing bond was completed between birds subsequently sexed, however, the persistent visitor was a female.

The time required for pair formation from step 1 to step 5 varied greatly. In some cases the steps overlapped and the whole procedure appeared to be completed in five or ten minutes. At other times including two cases under close study, the primary squatter never succeeded in obtaining a partner and after about a week gave up and disappeared. It is actually impossible to assign a definite time span for the establishment of a pairing bond, since the relationship, being little more than simple intra-individual tolerance, may occur in varying degrees and may be gradually intensified after the essential elements are established.

The principal differences in behavior which assured a heterosexual bond appeared to be, first, the greater persistence and speed of males in repeatedly returning to specific sites at the onset of clustering (territory establishment), and secondly, the greater persistence of females in returning to established squatters in the face of territorial aggressiveness.

NATURE OF THE PAIR RELATIONSHIP

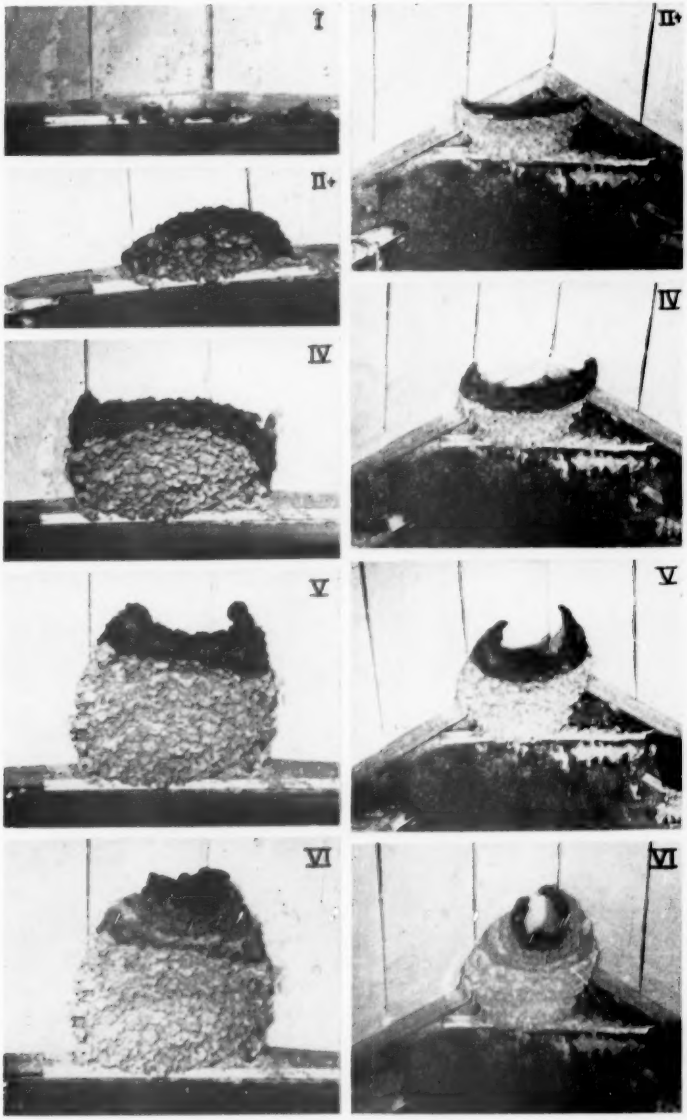
The pairing bond appeared to be largely, if not entirely, a relationship of mutual tolerance at the nesting site. Evidence of more complex interactions, such as has been described for various other species was not detected. From its nest entrance, a bird would quickly and accurately distinguish its mate from others approaching the colony, yet would make no special response when its mate was attacked as it visited a neighboring nest only a few feet away.

Pair relationships were not detected away from the nest. Mates were never seen to occupy neighboring perches on the community loafing sites, and could rarely be found together in the same perching group. They were never noted to associate closely at the mud gathering puddles. In the few cases where individually marked birds were recognized in song clusters or in promiscuous copulatory activities at the mud puddles, mated birds were never noted to be associated.

The pairing bond, although pretty well established before nest-building had started, was strengthened by joint participation in the activities of nest construction and the defense of the territory or nest site. The nature of the relationship may best be seen in observations of these two activities.

Cooperation in Nest Building.—The carrying of mud pellets to the site of pair formation generally started before the pairing bond had been completely established (step 3 or 4). The male seemed to initiate the work, but the female soon joined in and, in some cases, took as active a part as he did. The usual procedure was for the birds to take turns, one remaining at the site while its mate was away collecting mud. The exchange at the nest site was typically rapid and unceremonious. The arrival of one was the signal for departure of the other. When this occurred before the incumbent had finished working its last pellet into the nest rim, however, the newcomer would crowd in behind and then push forward. In early stages of construction when the ledge was still narrow, this frequently led to the displacement of one or the other bird. Each bird seemed intent on its work and paid no noticeable attention to its mate except for a soft note of greeting as it landed and a harsher double note as it left.

Although building activity was started in a new colony well before the clustering behavior of pair formation had subsided, the two activities remained very distinct. The early morning hours were largely filled with pair formation activities, raiding, and nest defense. Then, often quite abruptly ,the birds would shift their whole activity to nest building. One bird would appear with mud and, ignoring the pairing



PROGRESSIVE STAGES IN NEST CONSTRUCTION, VERTICAL AND DIAGONAL VIEWS. Roman numerals indicate stage of development as described in the text. Fresh wet mud added during the day appears dark.

activity around him, busily work his pellet into place on the nest rim. Within a few minutes nearly all the others in the colony or colony section would shift their activities in the same way, changing the whole tenor of activity in the flock (Emlen, 1952: 186). Individuals engaged in building dropped completely all traces of pairing behavior. Each bird appeared to give its full time and attention to the task even, at times, to the extent of ignoring trespassers stealing mud from another part of its nest. After a half hour or so of intensive building activity, the entire flock might revert to clustering and territorial defense or to loafing until, quite unpredictably, another session of nest building would be initiated. As nest construction advanced, the distinctness of these periods waned, and birds would frequently intersperse nest building with defensive behavior.

Primary squatters, presumably males, that failed to secure partners by the time nest building was under way in the colony joined in the mud carrying under the stimulus of their more successful colony associates. Two nests built by such single individuals advanced to stages II or III before the bird gave up and disappeared. In another case the builder finally secured a mate when his nest was at stage III. One unpaired bird became so occupied with nest building that he consistently ignored potential mates that came to the site; his nest fell on the fifth day suggesting that it was of inferior construction. Another bird late in the season acquired a mate which failed to assist him in nest building. The nest, as a consequence, advanced slowly, the mate became less and less regular in its appearance, and the pairing bond was gradually dissolved before the nest was completed.

Nests started by single birds were narrower than the typical nest. Incomplete, generally undersized shells are often found near the edge of advanced colonies and may represent the efforts of such unmated individuals.

Defense of the Nest Site.—Defense of the nest site was essentially no different from the intolerance of close association demonstrated by birds wherever they congregated. Its only unique characteristic was its localization. Aggressiveness exhibited at the first clusterings at the colony site (step 1 of pair formation) appeared the same both qualitatively and quantitatively as that seen after the bond and the nesting territory had been thoroughly established. From the beginning, the extent of the defended territory around the nest was apparently determined by the reach of the bill from the nest rim, a distance of about four inches (Emlen, 1952: 190). Nesting birds spent much time watching colony mates fly past and flutter up to neighboring nests. They occasionally made threatening gestures

toward those that came close, but rarely attacked except as an intruder actually alighted within reach. No essential changes were noted as the nesting cycle progressed except that the occasion for defense was reduced with the completion of the nest and the reduction of the opening from a broad ledge to a narrow hole.

Defense by the members of a pair was apparently entirely independent; an attack by one member rarely being joined by the mate. Exceptions in which both members took part occurred when the two were together at the nest opening. At such times, however, the birds showed nothing that could not be most readily interpreted as coincident independent attacks. After construction was completed and the eggs laid, males were perhaps a bit more aggressive at the nest than females, but this difference was not clear. In three nests, males started roosting on their nests at night when construction had proceeded to about stage V. Females started at the same time or a few nights later, but it was the male that generally came to the entrance first when a flashlight was turned on the nest. In one nest, the male regularly perched in the nest entrance during the early hours of the night.

No defense was used against English Sparrows in the two colonies where these birds were usurping nests. The swallows quickly stepped aside with or without alarm notes and allowed the sparrows to take over. No instances were seen in which sparrows attempted to enter a nest containing young. Mr. Bodeman, on whose barn the large Deerfield, Wisconsin, colony was located, informs me, however, that the swallows fly about in great alarm but make no move to interfere.

The alarm evoked by human interference was exhibited by all colony members and appeared to be a general alarm, although some nest owners showed increased excitement when their particular nests were being examined. Attacks on the human intruder, such as is characteristic of the Tree Swallow did not occur. Isolated pairs and birds in small nesting groups showed more alarm (called longer and more frequently) than those in the large colonies.

COPULATORY BEHAVIOR

Copulatory behavior of an abortive nature occurred on the loafing perches, at the mud gathering sites, and possibly also on the wing in the chases precipitated by flight singing. Resting or mud gathering individuals of either sex were suddenly pounced upon by a bird from above, and seized by the crown or nape feathers. A tussle ensued in which the aggressor characteristically spread its tail and apparently tried to establish cloacal contact. Interpretation of these perfor-

mances was difficult, however, and often they seemed no more than aggressive attacks. In the two instances observed where individual identities were determined, the bird selected by the aggressor was not its mate. The conditions under which they most often occurred suggest that they were typically promiscuous and independent of mate- or sex-recognition.

Complete copulations regularly occurred on the nest and were never observed elsewhere. They characteristically occurred between the two members of a pair after a period of quiet perching together in the nest. On two occasions, however, they were performed in a hurried manner by visiting males from neighboring nests during the absence of the owner. The females showed no reluctance in accepting these males, but in one case the female joined her mate a few seconds later in a violent pursuit of the intruder.

In a mated pair in the copulatory phase of the nesting cycle (immediately preceding and during egg laying), the male characteristically initiated copulatory activity by repeatedly leaving his mate at the nest entrance to retire to the nest cup and crouch in a posture suggestive of the squatting of a receptive female (plate 8, E). Each time he did this he would utter the soft "ksh-ksh" call commonly used between members of a pair at the nest. In most cases, the female made no detectable response to this behavior but sat passively at the nest entrance, looking out. At other times she raised her bill and turned her head slightly as though looking back over her shoulder and sang softly. To this the male responded by retreating farther into the nest and crouching. Such performances were repeated at irregular intervals for as much as 15 or 20 minutes without any particular display of excitement. Finally the female followed the male back into the interior of the nest. Here she crouched and permitted the male to mount with violently flapping wings (plate 8, F).

Nest construction had in all cases progressed to the shallow cup stage (III) or beyond before copulatory behavior started. A nest of at least this size would seem necessary for the copulation preliminaries described above, and may feature in the onset of the behavior. Copulating birds generally tumbled from the rim in cup stage nests, apparently before the act had been completed. In more advanced nests, however, copulation was completed within the nest. The female then shook herself and resumed her post at the entrance. The male likewise returned to the entrance but frequently returned to the nest cup three or four times as though inviting a repetition of the procedure.

As many as five copulations were observed between the members of a pair in one morning; three occurred within one seven-minute period, and the shortest interval recorded between copulations was about two minutes.

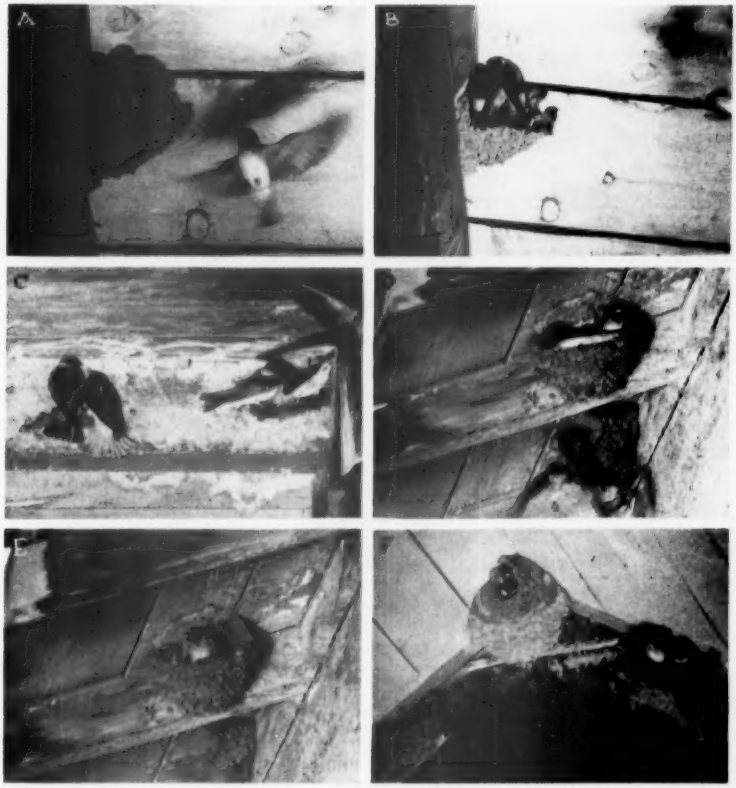
Precopulatory behavior in a nest, although relatively quiet, frequently aroused excitement among the birds in neighboring nests. There was no evidence of contagious behavior at these times, but visiting was increased, and the nest of the mating pair often became the center of considerable clustering and chasing. In wide-open nests in stage III or IV of construction, the resulting confusion was considerable, and outside birds repeatedly gained entrance and apparently attempted copulation. Defense against these intruders was largely, if not entirely, conducted by the male, who at times was left panting by the frenzied activity. Intruders at these times were persistent but rarely put up more than a brief defense against the resident male. In advanced nests with smaller entrances (stages V, VI, or VII), defense of the nest was far simpler, but intruders still persisted and occasionally gained entrance. A rough-and-tumble scramble followed during which additional birds sometimes crowded in to add to the confusion. After from 10 to as much as 30 or 40 seconds the intruders would tumble from the opening, frequently dragging one or both of the residents with them in a squirming, flapping mass.

In two nests under intensive daily observation, the first egg was laid 4 and 6 days, respectively, after the first observed copulation at the nest. Copulations were seen nearly every day thereafter until the middle of the laying period. The latest observed occurrence was on the afternoon preceding the laying of the last (fourth) egg.

DISCUSSION

Territory plays an important role in pair formation in a large number of birds. The male, arriving first, establishes himself and drives off all others of his kind until a female invader, recognized through appearance or through behavior, is accepted as the mate (Lack, 1940). This is essentially the procedure followed by the Cliff Swallows here described except that the whole procedure has been greatly intensified by the small size of the territories, the simultaneity of activities and the strong gregariousness of the birds.

Territory.—In most birds the procedure of territory establishment seems to involve two changes of behavior: a) localization of activity and b) increased intolerance of associates. In the Cliff Swallow only the first of these two changes is apparent. The universal intolerance of close crowding observable wherever swallows are congregated simply



PAIR FORMATION AND COPULATION POSTURES. *A*. Clustering of non-breeding birds at a potential nest site on the side of an old nest. *B*. Typical postures assumed by the primary squatter (*left*) and secondary visitor (*right*) in early stages of pair formation. *C*. A squatter and visitor in early stage of pair formation (*left*) and a partially mated pair in a song duel (*right*). *D*. A pair completely tolerant of each other (pairing bond completed). *E*. Male retiring into nest cup preparatory to copulation. *F*. Copulation in a stage VI nest.

becomes associated with a specific site through repeated visits. The degree of intolerance and its extent apparently change but little with this locality fixation except as the enforced position of the bird may handicap or aid his activities. Thus, a bird alighting on a vertical nesting surface before the nest has been started is obliged to cling facing inward in a position ill suited to defensive activity, while later, facing outward on a nest rim he can readily watch for and fend off invaders.

Pairing and mating functions are considered by Mayr (1935) to be at the root of all territorial behavior, the other functions such as food allotment and population control having appeared incidentally as secondary attributes. Such reasoning applies well to the Cliff Swallow where territorial behavior and pair formation are inextricably linked. The male selects a site or territory and repeatedly returns to it, aggressively repelling all who cluster around him. Through aggressive persistence, one of these visitors, a female, finally succeeds in penetrating the territorial barrier to establish a pair relationship of mutual tolerance with the male. Territory performs a further function in strengthening or fixing this bond by serving as a refuge from the social strife outside in which the pair may associate intimately in nesting activities.

Another basic function of territory which has been emphasized by Nice (1941, 1943) is the prevention of interference in raising the young. This function is particularly clear in the Cliff Swallow where territories are small and closely packed. Experiments with the breaking of nest walls (Emlen, 1952: 193) suggest that without such physical supplements to territorial boundaries successful nesting might be quite impossible in the Cliff Swallow. Protection against interference in nesting is accomplished by a combination of mud walls on five sides and defensive behavior on the sixth.

Song.—Modern interpretations of bird song generally suggest a dual function of a) repelling territorial intruders and b) attracting potential mates. In the Cliff Swallow singing is associated with displays of aggressiveness and, around the nesting colony, appears to be a direct response to intruders on or near the territory. This suggests that song might properly be interpreted as a threat or, perhaps, a symbolized "intensionsbewegung" or incipient form of attack. Song, however, serves as an attractant rather than a repellent to other birds, which swarm in and cluster around the singer. It thus fails completely as threat if the function of threat is to repel.

A function of attraction in a context of aggressiveness suggests motivational interpretations implied in the words challenge or defiance. Such terms have no objective meaning, however, and add

nothing to our understanding of the behavior except as they suggest subjective experience. The same criticism applies to such common interpretations of bird song as proclamation, self-assertion, advertising, satisfaction, eagerness, or longing. They may suggest attractive parallels with human behavior which are recognized in subjective experience, but such analogies are unprovable and potentially misleading. The only objective way to interpret bird song is in terms of its causes and effects; the situations which induce it and the responses which it elicits.

The environmental situations associated with singing in the Cliff Swallow have already been reviewed. Song was most prominent at the colony sites during pair formation but occurred wherever birds congregated on loafing perches, at mud sites or in foraging flocks. It was used both by aggressors and defenders and was employed as a prelude to as well as an accompaniment of actual conflict. Less commonly, singing occurred in lone birds left behind at the colony site or in relatively isolated birds at the edge of a foraging flock. In such cases it presumably reflected physiological disturbances similar to those which occurred in the conflict situations.

The effect of singing was to elicit attack or more singing by neighboring swallows. In dense flocks it often led to a confused chorus or a maelstrom of fighting involving half a dozen or more birds. Song thus served to create and maintain a condition of intense excitement at the scenes of territorial establishment and pair formation. One of its primary functions may well be that of a stimulating agent in advancing these essential activities of the reproductive cycle.

Song also functioned to attract other birds, including females, to the territories. While the behavior of both the attractor and the responding visitor was aggressive, we have seen how such aggressiveness is gradually suppressed and eventually replaced by tolerance in the process of pair formation. No repelling effects of song were detected.

The use of song away from the nest site may be interpreted in terms of causation as described in the preceding paragraph and need not raise questions of additional functions.

Sex Recognition.—Tinbergen (1939) has noted that in species where sex is not readily detected by morphological or vocal characters, sex recognition is generally slow and is accomplished in a series of behavioral interactions between the two birds. The Cliff Swallow seems to follow this pattern.

Differences in behavior during the period of pair formation were subtle and to all appearances merely quantitative variations of

characters common to both sexes. They seemed to consist primarily in the amount of initiative and of persistence shown in clustering at the prospective nesting sites. Males showed more initiative in selecting sites and squatted on them more tenaciously than did females. Females were slower and more hesitant in selecting sites, but more persistent in withstanding the repelling actions of birds already on a site.

These differences, it should be noted, are of a social rather than a sexual or epigamic nature. The absence of epigamic elements in the process of pair formation is, in fact, quite striking and emphasizes the distinctness of pairing and mating activities. True sexual behavior in the form of precopulatory and copulatory activities was conspicuously absent during the process of pair formation. Away from the colony sites it persisted, may even have increased, in the form of promiscuous matings at the mud gathering sites and on the loafing perches. At the nesting sites, however, it was conspicuously absent until after the intense activity of clustering and nest establishment had subsided.

The question often raised in discussions of pair formation as to whether sex, per se, is recognized seems quite meaningless in this case. The birds apparently established recognition of a specific individual after a period of intense interaction in which differences in social behavior favored a bond between opposite types.

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April 14, 1953.

A NESTING STUDY OF THE BLACK TERN IN MICHIGAN

BY NICHOLAS L. CUTHBERT

Introduction

During the summer of 1950, I made a study of Black Terns (*Chlidonias niger surinamensis*) nesting in the Indian River Marsh, 25 miles south of the northern tip of Michigan's Lower Peninsula, in Cheboygan County. Between June 24 and August 14, I visited the marsh 38 times; each visit was of six to nine hours' duration (excepting two one-hour trips). Twenty-seven nests were found, and the majority of these was visited repeatedly. Particular attention was given to two nests.

In 1951, I continued the study making two or three trips each eight or nine days from May 19 to June 15. From June 21 to August 22, trips were made almost every day for a different study, but some observations pertained to general nesting habits of the Black Tern and are included here.

The author wishes to express his deep appreciation of the many valuable suggestions made by Dr. Olin Sewall Pettingill, Jr., during the course of the study and during the writing of the manuscript. Grateful acknowledgment is also due to Mabel Jaques Cuthbert and Knut J. Norstog for their identification of the common plants of the area. This study is a contribution from the University of Michigan Biological Station. It was financed in part by a grant from the Michigan Academy of Science, Arts and Letters.

The Study Area

The Indian River flows into Mullet Lake from the southwest. Many years ago a dam was placed at the outlet of Mullet Lake, raising the level of the lake and causing the river to overflow. The resulting flooded area, the Indian River Marsh, is about three-quarters of a mile in width and extends for two and one-half miles southwest from the head of the lake; the river channel, 100 to 200 feet in width, meanders through the southeastern side of the marsh. My study area covered approximately one-eighth of the marsh—a strip three-tenths of a mile wide and extending for nine-tenths of a mile along the river channel from a point about one-fourth of a mile above the river mouth.

Large portions of the study area, as well as the rest of the marsh, contained extensive growths of common cat-tail (*Typha latifolia*); next in abundance were two species of bulrush (*Scirpus validus* and

S. acutus). Occasionally in shallow water bordering the river channel and in open areas among the cat-tails and bulrushes, there were patches of sweetflag (*Acorus Calamus*), broad-fruited bur-reed (*Sparganium eurycarpum*), water-lily (*Nymphaea tuberosa*), yellow pond-lily (*Nuphar variegatum*), Canadian waterweed (*Elodea canadensis*), buckbean (*Menyanthes trifoliata*), arrowhead (*Sagittaria latifolia*), spike-rush (*Eleocharis* sp.), hairy-fruited sedge (*Carex lasiocarpa*), pickerelweed (*Pontederia cordata*), and wild rice (*Zizania aquatica*). The alga *Chara* sp. was extremely abundant and blanketed the floor of much of the open shallow water. The river channel supported luxuriant growths of water-milfoil (*Myriophyllum* sp.), mare's-tail (*Hippuris vulgaris*), and four species of pondweed (*Potamogeton*). (Names from Gray's Manual of Botany, Eighth Edition, 1950.)

MATERIALS AND METHODS

For the first two weeks (June 24 to July 7, 1950) I made daily trips through the study area to gather information on nest distribution, hatching-time, and activities of the young. Since the nests were quite close to open water and the water over much of the marsh was one to three feet deep, I approached the nests in a small rowboat.

The period between July 8 and August 14, 1950 was devoted primarily to watching two nests and to following the activities of flying juveniles. The observations on nests were made from a canvas blind, $3\frac{1}{2} \times 3\frac{1}{2} \times 4$ feet in dimensions, mounted in a rowboat placed 6 to 15 feet from the nest. At first the boat was pushed into place near a nest each day and the blind erected anew for each observation. Later, the rowboat with the erected blind in it was left beside a nest. The habits of the flying juveniles were observed through a 20-power telescope on a tripod in an open rowboat, approximately 150 feet from the feeding territories.

In 1951, I visited the marsh on May 19, 20, 29, and 30 and June 7, 8, 9, 14, and 15, gathering data on display flights and courtship, because in 1950 observations began too late in the season to study these activities. Almost daily additional trips from June 21 to August 22 were to study Black Terns under semi-captive conditions as will be reported elsewhere. However, some coincident observations are inserted here.

To aid in identification of individual birds, six adults and 20 young were color-banded. However, most identifications of individual adults at nests were made by noting carefully the progress of the postnuptial molt (described by van Rossem, 1923). The early stages of the whitish winter plumage appeared on the head and neck in very distinctive patterns and (with one exception) made it possible to recognize

individuals in a pair. The progress of the molt is very slow, an individual changing very little from day to day.

DISPLAY FLIGHTS

Palmer (1941) made an extensive report on display flights and courtship behavior in the Common Tern (*Sterna hirundo*). Since it is important to compare the relatively unknown behavior of the marsh-nesting Black Tern with that of the land-nesting Common Tern, I will follow Palmer's terminology and sequence of presentation as closely as possible.

Fish flights.—Palmer (1941: 40–44) pointed out that Common Terns in the process of occupying a ternery frequently exhibited a social activity called the "fish flight." Typically, one bird flew carrying a small fish or other prey and called slowly with head in "bent" position (bill pointed downward), while a partner in "straight" position (bill pointed forward) silently flew ahead. "A Common Tern with a fish may make such flights nearly as frequently as one per minute. Sometimes a new partner is present at each flight." Bent and straight roles were interchangeable and often three birds joined in a flight and the fish was passed from bird to bird. Flights took place only on a few days in mid-May, and Palmer believed that they were primarily a social, pre-courtship activity before sex recognition occurred. Fish flights by Black Terns lasted from 5 to 15 minutes. A fish was sometimes carried, but more often a small insect. Occasionally a dragonfly (Odonata) was carried. Usually the carrier flew in the rear position with head bent and called with short, slow-cadenced cries similar to those used later when flying to young with food. The non-carrier flew silently with beak straight forward. I did not see food passed between partners and believe this difference from the Common Tern is correlated with the fact that the Black Tern (unlike the Common Tern) does not bring food to the incubating mate at the change-over.

There were many variations in the flight. In two cases, the carrier occasionally took the lead. Sometimes two birds flew alone for a while and then were joined by two more. On May 20, 1951, from 12:55 to 1:10 p.m. I watched four birds together flying rapidly around and around in strenuous fish flight. The circles were sometimes large, sometimes small, at times high in the sky or, again, low over the marsh. The flight covered an area approximately one-third of a mile in diameter. The rear bird carried a fish, but I could not determine significant positions of the head. At 1:02 p.m. the carrier dropped the fish, recaught it in the air, and swallowed it; thereafter the flight continued but at a slower rate.

The greatest number of fish flights was seen on my earliest visit to the marsh (May 19 to 20, 1951) when 18 flights were counted in 14 hours. Flights counted were a small fraction of those taking place. As with the Common Tern, the fish-flight phase was brief and, apparently, was a pre-courtship activity, since on my next visit (May 29 to 30) no flights were seen during 17 hours, and on 56 visits (one to ten hours each) through the summer only four flights were seen.

Flock flights.—Palmer (1941: 40–41) mentioned that Common Terns in the process of occupying a ternery may become quiet and suddenly "fly up in a body and return to social life for a time." On May 20, I watched spectacular flock flights of Black Terns which were apparently in the process of pairing. As I sat in a rowboat in one of the main nesting areas, approximately ten "pairs" of birds were visible on rudimentary nest platforms in the surrounding low, dead bulrushes of the previous year. Many others were calling from points out of sight in the vegetation. Suddenly at 3:55 p.m., they all became quiet and then flew up as a flock of at least 100 birds. They resumed calling and climbed noisily into the cloudy sky. Within the flock, many individual pairs occasionally set their wings and swooped downward in long, aerial glides (see below). Suddenly the entire flock became momentarily silent and, on set wings, made a single, swooping aerial glide. The flight then continued with further occasional aerial glides by individual pairs. Twenty minutes after the flight started, birds began dropping back on the rudimentary nest sites, and in a moment the flight was over. A minute later a second flight began and lasted for 14 minutes. In this flight, the whole flock made several long, swooping, silent aerial glides. At 4:54 and 5:18 p.m., two more flock flights began but did not "take." Approximately one-third of the birds flew up for about half a minute, then, probably because the rest did not follow, dropped back on the nesting areas. No further flock flights had taken place by 6:00 p.m.

I believe these flock flights were transitional steps from a flocking phase to the nesting phase, since nine and ten days later (May 29 and 30), when egg-laying had begun, I watched the marsh for 17 hours and saw only very minor flock flights. In all, there were seven flights lasting from 40 seconds to four minutes on those two days. Thereafter, no more were seen through the summer.

Trautman (1939: 44–45) saw "twilight flights" of the Black Tern, in which large flocks variously circled, swooped, and ascended in spirals. These flights started shortly after sunset and lasted, on some nights, until 10:00 o'clock. They took place from early June to

August. I watched for this flight on 19 evenings in 1950 and 1951 but did not see it.

COURTSHIP

For the Common Tern, Palmer (1941: 44–49) divided courtship into four activities: (1) Posturing. This included a *bent position* with head down, wings drooped, and tail tilted, followed by an *erect position* with head raised, bill pointed upward, tail tilted, and wings drooped. (2) The parade. "A bird, frequently in the bent position, walks in a circle, or arc of one, about the other tern." (3) Incipient nest-building. This included *scrape-making* (digging a hollow in sand as for a nest), and *twig-tossing* (picking up bits of "nest material" only to drop them again). (4) Aerial gliding. In this "A pair of birds may fly close together and high in the air. All of a sudden, one partly folds its wings and starts to glide quite leisurely earthward. The other keeps pace with it [gliding] . . ."

Posturing in the Black Tern usually began with one bird (the male?) standing upon a floating mat of vegetation on which a few plant stems were drawn together as a potential nest platform. Sometimes the bird stood on a post in the river or on a bare log floating near the river's edge. When a second bird flew overhead, the standing bird dipped its head down, tipped its tail up, and emitted low "chortling" sounds for about five seconds. This apparently corresponded to the "bent position," but no significant drooping of the wings was noted. The second bird alighted an inch or two from the first, whereupon both immediately craned their necks straight up for about ten seconds, pointing their beaks upward (erect position). Both then relaxed and stood preening quietly.

I did not see the "parade" in the Black Tern and doubt if it occurred. The scrape-making phase of incipient nest-building was lacking because of the nature of the Black Tern nesting habitat. Twig-tossing was also lacking, but the birds did frequently drag together small piles of plant material to form scant nest platforms on which they postured.

During aerial gliding, the Black Tern was silent and did not carry fish. Typically, two birds flew high and fast, then set wings and swept down rapidly toward the marsh, keeping a constant distance between each other as if the rear bird were on a tow-line. They often dropped two or three hundred feet, then swooped upward approximately 50 feet. In contrast, Witherby *et al.* (1941: 3), wrote that the European subspecies of the Black Tern "sometimes performs a gliding display flight, comparable to Common Tern's, but only from a small height . . ."

Seventeen aerial glides were seen on the earliest visit to the marsh (May 19, 1951); approximately eight on May 20. These counts were of aerial glides by individual pairs and did not include the hundreds of glides seen within flock flights, nor the social glides when a whole flock swooped down at once. According to Palmer (1941: 49–51), the aerial glide of the Common Tern maintained the sexual bond between mated pairs through the nesting season. In the Black Tern the aerial glide was rare after the eggs were laid. In fact, successfully nesting pairs could not do aerial glides until the young were at least five days of age, because one mate or the other was on the eggs almost 100 per cent of the time, and for the first five days after hatching one or the other was continuously feeding or brooding the young. From May 29, when laying had begun, to July 5 only seven aerial glides were seen on 21 daily observation periods of approximately five hours in length. After July 5, when young at many nests were quite well developed, aerial gliding of mild intensity took place and four, four, zero, approximately ten, and four glides were seen on July 5, 6, 8, 9, and 11, respectively.

NESTS

From my observations and from previous descriptions by various authors, I believe that Black Terns should be considered as only partly colonial. On a 1000-acre area in northwestern Iowa, Provost (1947: 500) found "many well-scattered groups of 10 to 20 nests, interspersed with isolated nests," and "isolated nests on small ponds were frequent." Pittman (1927: 140–141) described Black Terns nesting in Saskatchewan in a colonial manner, but with the nests "dotted here and there . . ." Witherby *et al.* (1941: 3), writing about the European subspecies (*C. n. niger*), stated that it usually nests in colonies but sometimes in scattered pairs. In contrast, Hoffman (1926: 86) described a Wisconsin marsh where it was "not unusual to find a half dozen nests in . . . twenty-five square yards."

Of the 27 nests I found at Indian River in 1950, 17 were in a loose colony in a 20-acre tract and ten were scattered in five sets of two each at various distances from the colony. In the colony, each nest was within 100 feet or less of at least one other nest; the three most closely associated nests were, respectively, 30, 36, and 37 feet apart. In the case of the five scattered pairs of nests, the distances separating the two members of each set were respectively: 31, 25, 40, 121, and (approximately) 50 feet; the distance between the pairs of nests varied from 100 yards to one-eighth mile.

Nest sites.—The nests were located in various vegetation types as follows: 18 in bulrushes, two in bulrush and cat-tail mixtures, three in cat-tails, two in cat-tail and yellow pond-lily mixtures, and two in bur-reeds. The birds had a definite preference for areas where the vegetation was low and thin. Most commonly this was afforded by thinly scattered bulrushes within a few feet of open water. However, two nests were in dense cat-tails through which a small rowboat could be poled only with considerable effort. But even these nests were only 15 and 20 feet from open water and were placed in a local clearing in the vegetation made by muskrats (*Ondatra*).

All save four of the nests were on floating platforms in water at least two feet deep; as waves from the river channel swept through the marsh, the nests rose and fell gently. In Iowa, Provost (1947: 499) found few nests in water less than two feet deep, which seems to be the usual situation in America; Witherby *et al.* (1941: 3) wrote that the nests of the European subspecies are also generally floating. Bisseling (1930: 60) observed this subspecies in the province of South Holland and found that "nests . . . consist of a fairly substantial structure of decaying plants and weeds which can rise and fall with the water." However, Turner (1920: 125–126) also studied the Black Tern in The Netherlands and wrote "I saw no floating nests anywhere." He found nests on "narrow strips of rough herbage lying between the dykes." Likewise, de Morsier (1947: 142) found nests in Dombes, France, "sur terre ferme." In the last two cases, clear photographs show the nests in coarse, low vegetation. No water is evident in the pictures.

Of the floating nests at Indian River, 11 were built upon very thin mats of dead plant material which had drifted and lodged against the stems of the surrounding vegetation; five nests were on floating logs or boards; five on bulrushes cut by muskrats; and two on stems of broken-down bulrushes. The muskrat-constructed platforms (similar to those described by Cahalane, 1947: 533) consisted of freshly-cut bulrush stems arranged in a radiating pattern. Of the four platforms which were not floating, one was an extensive pile of old bulrushes and three were extremely flattened old muskrat houses. Provost (1947: 499) found platforms of similar material and also nests on algal mats. He found one nest built in a recently-used nest of an American Coot (*Fulica americana*).

A nest was wet or dry, depending upon the weather and upon how well the platform held the nest above the water. Occasionally extreme wave action washed away parts of a nest and left mere fragments, the eggs resting precariously near the water's edge. In such a case, the nests usually were built up again by the following day.

Nest materials.—Knox (1899: 132) watched a Black Tern building part of a nest and observed that "the materials which could have been had directly at hand, were brought from a distance." He watched the bird fly in with nest material (weed stems) in its beak 14 times in half an hour.

I did not see nest-building in preparation for egg-laying. The material of each nest observed was dead vegetation similar to that scattered about in the immediate vicinity. Nests in cat-tails were constructed principally of pieces of old cat-tail leaves, whereas nests in bulrushes were made of short, broken bulrush stems from the previous year. I did not observe a single case of a Black Tern flying and carrying nest material. I observed in detail the building of an "auxiliary" nest (see below) and, as in nest reinforcement during incubation, all material was gathered from the water within a few feet of the nest site.

EGGS AND INCUBATION

Provost (1947: 499) stated that the first nest of the season was found on May 26, and by June 4 "black tern nesting was well under way" (Iowa). Hoffman (1927: 79) found a nest containing three eggs on June 6 (Wisconsin). Turner (1920: 122) observed incubating birds on May 21 (The Netherlands). In 1950 at Indian River, I found large numbers of newly-hatched young from June 26 to June 29. Allowing 21 days for incubation, egg-laying must have begun between June 6 and June 9. However, in 1951, I found 14 nests containing one to three eggs on May 29. The latest laying date which I recorded was June 30 or July 1, 1950.

The incubation period was given as 17 days by Seton and Chapman (1904: 1) and subsequent authors have cited this figure although it was based on observations on a single nest. Mr. Robert Goodman checked the incubation period of six marked eggs at a marsh near Pulaski, New York, in 1952 and has written me that "the average of the six was 21 days and 2 hours." In 1951, at Indian River, I observed six nests containing a total of 16 marked eggs. All eggs were still unhatched when I checked them at 19 or 20 days of incubation. I was unable to check them again until six days later by which time all had hatched.

Clutch size at Indian River varied from one to three. Of 20 nests found with eggs in 1950, each of ten contained three eggs, five contained two, and five contained one, a mean of 2.25 eggs per nest. The clutches were found at various stages of incubation, and some nests had perhaps already lost an egg or eggs. According to Bent (1921:

293) the "full set is almost always three eggs, occasionally two, and very rarely four or even five."

Black Terns at Indian River were very close sitters and, unless molested, rarely left their eggs uncovered for more than a minute or two at a time. Day after day as I went from nest to nest, a bird was always on the eggs and usually remained until I was within 30 or 40 feet of the nest. During this period (June 24–July 21, 1950) the temperature was usually rather low. (At the University of Michigan Biological Station nine miles from the marsh, the maximum temperature rose to above 80° F. on only 13 of the 28 days, and the highest temperature reached was 89° F.—recordings made by Dr. F. C. Gates.) It was variously "windy and cold" or "slightly overcast" or "cold and foggy," except for five days (July 8 to 11 and July 20) of hot and sunny weather. It is possible that the parents would have been less attentive if the weather had been warmer; Roberts (1877: 36) in Minnesota found that "during the day the parent birds sit on the nest very little, leaving the incubation of the eggs greatly to the heat from the sun and the warmth arising from the damp decaying vegetable matter upon which they rest."

In addition, I watched Nest 22 from a blind for a total of 666 minutes, July 17 to 19, the last three days of incubation; the eggs were covered 97.3 per cent of the time, being left untended for a total of only 15 minutes (20 very brief flights from the nest). The temperature on these days was quite low, the maxima at the Biological Station being respectively 80, 74, and 60° F.

During my observations on July 17 and 18, one bird alone incubated. On July 18, this bird (designated Adult Y and distinguished from its mate by the pattern of white winter-plumage feathers appearing on its head) remained on the eggs, except for 14 absences totalling nine minutes, from 2:16 to 9:00 p.m. (404 minutes). I did not see the mate (Adult X) in the vicinity during this entire interval. The following morning, however, Adult X incubated for 87 minutes of the 165 minutes observed, or nine minutes longer than Adult Y. Turner's (1920: 125) observations on the European subspecies were quite different: the "male" stayed on the eggs only once (for about ten minutes) during four days of observation, and he "spent all his time flying to and fro over his [incubating] mate, driving away Redshanks (*T. totanus*), Ruffs (*P. pugnax*), and other intruders." Palmer (1941: 79), working with the Common Tern, noted "that females did approximately three-quarters of the incubating" and that the "times between changing over varied from less than five minutes to over four hours."

The change-over at Indian River was very rapid. The returning bird flew over the nest and called. The sitting bird replied, then usually arose, and the other dropped down and quickly covered the eggs. Unlike the Common Tern, which sometimes brings a fish for its mate at the change-over (Palmer, 1941: 79), the incoming bird always flew in with empty beak. Sometimes the sitting bird did not leave the eggs, whereupon the returning bird alighted and pushed against it gently with its breast and caused it to arise. (Palmer described the same action in the Common Tern.) In either case, in the Black Tern, the outgoing bird either flew away immediately or remained for approximately one minute on or near the nest platform and gathered bits of vegetation which it piled about the mate on the nest. In gathering these, the bird often waded out about six inches into the surrounding water, where it was supported by various pieces of underwater vegetation projecting from the nest platform. Here it stood and, with great flapping of wings, stretched outward and grasped pieces of broken-off plant stems. It pulled these in one at a time and, with a quick jerk of the head, tossed them about the incubating mate. In a few moments it would pull in four or five of these thick, short stems. Again, a bird would wade out a foot or two from the nest, flapping its wings and dragging its belly and tail in the water as it worked. At times one momentarily submerged its entire head to grasp the stems. Palmer (*loc. cit.*) wrote of the Common Tern: "Sometimes at the approach of the mate, the incubating bird may pick up twigs or bits of grass and toss or slide them backward over its back . . . . This seems to be the result of a heightened emotional state caused by the return of the mate and sometimes the returning bird is the one exhibiting it." Possibly the formalized twig-tossing of the Common Tern is an evolutionary remnant of the more elaborate and useful nest-reinforcement activity of the Black Tern.

A failure of the change-over routines occurred occasionally when the incubating bird did not fly off but made low, chortling sounds and twitched its body when the mate called overhead. Turner's descriptions (1920: 125) for the European subspecies were similar to this: "When he swooped low over the nest, she would look up and reply to his call with soft, low notes; these were accompanied by a little vibrating movement of her whole body."

Within four to ten minutes after I entered the blind (at three nests in 1950, two in 1951), an adult returned and covered the eggs. Usually the bird was quiet and inactive and occasionally inserted its beak under its scapulars and slept lightly. At other times it preened or reached out and pulled bits of the nest up about itself. During one

observation period, a rather heavy rain fell and the incubating bird merely sat quietly for 31 minutes while the rain ran off its back. A Redwing (*Agelaius phoeniceus*) family frequently flew near one of the nests, and when one of these birds came within three to eight feet of the nest, the tern scolded, sometimes standing in the nest, occasionally flying off to chase the intruder. Unseen turtles, fishes, or other animals under the water at times caused the bulrush stems by the nest to sway; the incubating bird then became very excited, raised its wings, and scolded vigorously while reaching out with its head toward the moving plants.

None of the nests under observation on June 24 and 25, 1950, contained young. The peak period of hatching followed immediately (June 26 to 29), and scattered hatchings took place up to July 20. The number of nests in which the first young bird had recently hatched and the dates of these hatchings were: June 26—4 nests, June 28—2 nests, June 29—3 nests, June 30—1 nest, July 1—1 nest, July 2—1 nest, July 4—2 nests, July 5—3 nests, July 6—1 nest, July 19—1 nest, and July 20—1 nest.

In 1951, hatching began earlier. Five nests contained at least one recently hatched bird on June 14. Thereafter, because of other activities, I did not check nests for hatching as intensively as in 1950. However, the following dates were obtained for nests with one or more young just hatched: June 14—5 nests, June 25—1 nest, June 27—2 nests, June 29—1 nest, June 30—1 nest, and July 16—1 nest.

Hatching was observed from the blind at Nest 22 (which contained two eggs). Approximately 25 to 26 hours elapsed between the hatching of the two eggs. At 9:34 a.m. on July 20, 1950, I first noticed that one of the eggs was pipped. Presumably it had been pipped for some time, for it hatched between 11:37 and 11:47 a.m. the same day. An adult flew away with one piece of shell from this egg at 11:56 a.m. and with the other piece at 12:48 p.m. (A third adult alighted on the nest and briefly attempted to copulate with the sitting bird shortly after the first egg hatched. See below.) The following day, I first noticed at 8:47 a.m. that the other egg was pipped, and it hatched between 12:53 and 1:37 o'clock that afternoon.

Beginning approximately one-half hour before the hatching of the first egg, the adults became quite excited, as evidenced by frequent preening, turning about in the nest, and picking at the nest materials. This excitement continued until about half an hour after the egg hatched and was accompanied by a large amount of vigorous nest-reinforcement activity.

ACTIVITIES OF YOUNG BIRDS IN THE NEST

On July 20, 1950, a clear, hot day, one newly-hatched bird in Nest 22 was observed from the blind within ten minutes after hatching. This wet bird, with eyes open, was able to raise its head in a wobbly manner. Twenty-nine minutes later it called feebly with a *'chirr'*-like sound, raised its head upward, and gaped. Shortly thereafter, the adults made several attempts to feed it mayflies (Ephemeridae) but without success. Finally two hours and two minutes after hatching, the young bird accepted a damsel fly (Odonata) but swallowed it only after a considerable amount of gulping and swaying its head about. Half an hour later another damsel fly was taken, and four minutes later still another; 15 minutes later the first fish, a one-inch shiner (*Notropis* sp.), was accepted. The young bird remained continuously under a parent except when the mate flew in calling and carrying food; then the young bird pushed its head out from under the brooding parent and *'chirred'* in response. Two hours and 48 minutes after hatching, its down was dry and fluffy except for a few small patches. The young bird remained in the nest as I rowed away from the blind.

Day-old birds were observed on two hot, bright days—July 7 (Nest 1) and July 21 (Nest 22). During the first few hours after dawn, they remained continuously under the parent except while being fed. However, as the day progressed, approximately one hour was spent under the parent, then one hour in the open, lying beside the parent or wandering about the nest, then another hour back under the parent, etc.

Defecation probably occurred earlier, but the earliest I observed it was at one day of age. The young bird climbed to the edge of the nest, turned, placed its abdomen in the water and defecated. The nests remained completely clean.

Reactions of one-day-old downy young varied when I approached to enter a blind. In one case (Nest 22, July 21), the single young bird remained quietly on the nest. At Nest 1 (July 6) one of the two one-day-old birds remained in the nest (with a newly-hatched sibling) while the other swam out a few feet into the surrounding vegetation. This young returned immediately when the parent alighted in the nest and called to it with low, throaty notes after I had settled in the blind. Hoffman (1936) described the notes used to recall the young as "a soft, low cooing." In a third case (Nest 1, July 7), the single one-day-old bird swam a few feet from the nest as I approached, but it quickly climbed back, while I was settling in the blind and before the parent alighted.

Birds at two days of age were left alone in the nest approximately 25 per cent of the daylight time during 572 minutes observation and were more active than one-day-olds. They stood and walked ably. When the adults left the nesting area, the young birds peacefully wandered about the nest or stood quietly. At times they preened, scratched the head with a foot, '*chirred*', and picked at the nest and at stems hanging near by. Frequently they merely squatted and slept. During the heat of the day, they alternately spent approximately one hour under the parent and one hour by the parent on the nest (or alone in the otherwise empty nest). During an observation at Nest 22, which ran until 9:00 on a clear, very warm evening (July 22), the lone two-day-old downy young remained under the parent almost continuously after 5:30 p.m. except for feedings. At this age, young at Nests 1 and 22 swam as far as eight inches from the nest before turning about and defecating in the water. Drinking was first observed at this age and occurred frequently. It usually followed ingestion of some large item of food or a series of small feedings. The young birds walked to the edge of the nest, dipped the beak in the water, raised the head, and swallowed.

The two-day-old birds were more responsive than younger birds to the alarm notes of the parents. If a parent became nervous and flew off the nest calling with shrill, short cries in slow cadence, the young birds "froze" on the nest. If, on the other hand, the cries had a rapid cadence the young birds dashed off the nest in a fraction of a second; when the parent's calls dropped to a slow cadence again, they returned to the nest even before the parent alighted.

The activities of birds of three and four days of age were essentially the same as those of two-day-olds, except that they swam farther out from the nest when disturbed. However, in one case, at Nest 1, I approached and entered the blind at 4:30 a.m.—before dawn—and the three young birds remained stationary in the nest, packed side-by-side like three slanted dominoes, although a parent was calling overhead in the darkness. From 4:55 until 6:03 a.m. these three birds spent most of their time under the brooding parent but, as the day (July 9) became warm and bright, a parent was on the nest for only 43 minutes during 341 minutes of observation, and the young birds only infrequently burrowed under it.

I watched some four- and five-day-old birds at Nest 1 on a slightly cloudy, but hot, afternoon (July 10), and they were left alone in the nest most of the time. Between 2:00 and 8:12 p.m. one parent or the other was on the nest 14 times for a total of 85 minutes, but brooded

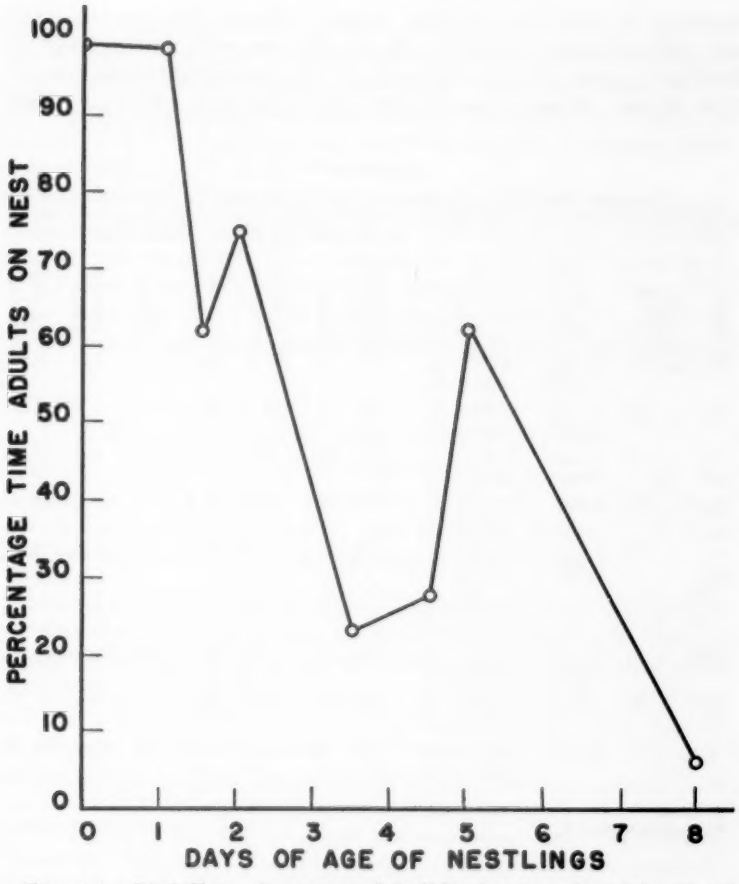

FIGURE 1. Black Tern. Percentage of daylight time spent by adults on nest. Young birds 0 to 8 days of age.

the young for only 19 minutes. After 8:12 p.m., however, brooding continued until I frightened the adult from the nest when I left the blind at 8:40 p.m.

One five-day-old bird at Nest 22 was observed from 5:30 a.m. until 1:45 p.m. on July 25. From 5:30 until 7:17 a.m. an adult was on the nest two-thirds of the time and kept the young bird covered. Toward the middle of the morning the day grew warmer and during the periods that an adult was on the nest, the young bird spent much of its time

standing or squatting by the parent. During the late morning and early afternoon, however, the sun became quite bright; most of the time a parent stood in the nest, and the young bird pushed under it for shade. When a parent was not on the nest, the young bird

TABLE 1

DAYLIGHT TIME NESTS COVERED OR NOT COVERED BY BLACK TERNS

					Periods nest covered			*Periods nest not covered*		
Nest	*Date (1950)*	*Age of young birds*	*Time*	*Total time in minutes*	*Number*	*Mean in minutes*	*Per cent of total*	*Number*	*Mean in minutes*	*Per cent of total*
22	July 20	(1 egg) 0-day*	9:34 a. m.–2:50 p. m.	316	3	104.7	99.4	2	1.0	0.6
22	21	(1 egg) 1-day	4:52 a. m.–2:00 p. m.	548	2	270.5	98.7	1	7.0	1.3
1	7	1- and 2-day	10:30 a. m.–1:17 p. m.	167	12	8.6	62.3	11	5.7	37.3
22	22	2-day	2:15 p. m.–9:00 p. m.	405	21	14.5	75.0	20	5.0	25.0
1 and 1**	9	3- and 4-day	4:55 a. m.–7:43 a. m. and 9:29 a. m.–1:30 p. m.	409	17	5.6	23.1	17	18.4	76.9
1**	10	4- and 5-day	2:00 p. m.–8:40 p. m.	400	15	7.5	28.1	14	20.4	71.9
22	25	5-day	5:30 a. m.–1:45 p. m.	495	36	8.5	62.5	35	5.3	37.5
1	13	8-day	5:15 a. m.–2:00 p. m.	525	4	8.0	6.1	5	98.6	93.9

* Hatched 193 minutes before end of observation period.
** Auxiliary Nest 1.

slept a great deal and usually raised its head only to be fed. Much of the feeding was done from the air, the adult hovering momentarily above the nest. The five-day-old was much more wary than younger birds and swam out about 20 feet from the nest as I entered the blind. The parent called a full 15 minutes before the five-day-old returned to the nest.

I watched a lone eight-day-old bird in Nest 1 from 5:15 a.m. until 2:00 p.m. on July 13. The day was cloudy and rainy and the parents stayed on the nest very little. Again, approximately 15 minutes elapsed after I settled in the blind before the young bird returned to the nest. Once, when the parents were away from the nesting area,

something frightened the young bird. It swam out two feet from the nest, remained there for ten minutes, and then returned voluntarily to the nest before the parents came back. In another case, after I had made a particularly prolonged disturbance near a nest, I found an eight-day-old color-banded young bird from the nest swimming vigorously through an open area 40 feet away.

Young of 9 to 25 days of age were not observed from a blind because of various difficulties. However, many birds of this age were caught, handled, and measured. As I approached a nest they swam away rapidly, and I recovered color-banded birds at distances of from 3 to 75 feet from their nest. They usually squalled loudly when picked up. The 19-and 20-day-old birds still were unable to fly when tossed into the air.

PARENTAL CARE OF YOUNG BIRDS IN THE NEST

Parental care of young birds of zero up to eight days of age was observed from the blind. Thereafter (and until the young were approximately 25 or 30 days of age), notes on parental care were gathered only as I rowed about the general nesting area.

Covering the nest.—Until the young were at least 8 days old, the parents shared in covering the nest (*i.e.* brooding or sheltering the young, or standing by them in the nest). For two days (at Nest 22) incubation and brooding overlapped, since eggs and young were in the nest simultaneously. During these two days, the period when one parent covered the nest was usually continuous with that of the other and the combined parental daylight time covering the nest (table 1) was 99.0 per cent of the 14 hours and 24 minutes of observation. It was thus very similar to the percentage (97.3) for the last three days of incubation. Thereafter, time spent covering the nest decreased rather regularly (with some fluctuations apparently due to variations in the weather) to 6.1 per cent at eight days of age. After the two hatching days, the change-over system broke down rapidly, and varying lengths of time elapsed during which both parents were off the nest. By two days of age, the mean length of the combined periods covering the nest had dropped very abruptly (table 1 and figure 1).

The data on length of time parents covered nests containing young are tabulated separately under the individual parents for Nest 22 (table 2) and Nest 1 (table 3). In these arrangements, the day-by-day decrease in time covering the nest recognizable in the combined parental analysis is masked greatly by individual variations. At Nest

TABLE 2

DAYLIGHT PERIODS NEST 22 COVERED OR NOT COVERED BY INDIVIDUAL ADULT BLACK TERNS*

Age of young birds	Total minutes observed	Adult X: Periods nest covered — Number	Mean length (minutes)	Per cent of total	Periods nest not covered — Number	Mean length (minutes)	Per cent of total	Adult Y: Periods nest covered — Number	Mean length (minutes)	Per cent of total	Periods nest not covered — Number	Mean length (minutes)	Per cent of total
(1 egg) 0-day**	316	8	19.7	49.7	8	19.8	50.3	9	17.4	49.7	9	17.7	50.3
(1 egg) 1-day	548	10	36.8	67.1	11	16.3	32.9	10	17.3	31.6	10	37.5	68.4
2-day	405	8	10.9	21.5	8	39.7	78.5	16	13.6	53.5	16	11.7	46.5
5-day	495	22	7.4	32.4	23	14.4	67.6	17	8.7	30.1	18	19.3	69.9

* From same data as material on Nest 22 in table 1.
** Hatched 193 minutes before end of this record.

TABLE 3

DAYLIGHT PERIODS NEST 1 COVERED OR NOT COVERED BY INDIVIDUAL ADULT BLACK TERNS*

Age of young birds	Total minutes observed	Adult A: Periods nest covered — Number	Mean length (minutes)	Per cent of total	Periods nest not covered — Number	Mean length (minutes)	Per cent of total	Adult B: Periods nest covered — Number	Mean length (minutes)	Per cent of total	Periods nest not covered — Number	Mean length (minutes)	Per cent of total
1- and 2-day	167	3	5.0	9.0	4	38.0	91.0	10	8.9	53.3	9	8.7	46.7
3- and 4-day	409	12	4.7	13.9	13	27.1	86.1	6	6.3	9.2	7	53.0	90.8
4- and 5-day	400	5	6.2	7.8	6	61.2	92.2	11	7.4	20.3	10	31.7	79.7
8-day	525	3	6.7	3.8	4	126.0	96.2	1	12.0	2.3	2	256.0	97.7

* From same data as material on Nest 1 in table 1.

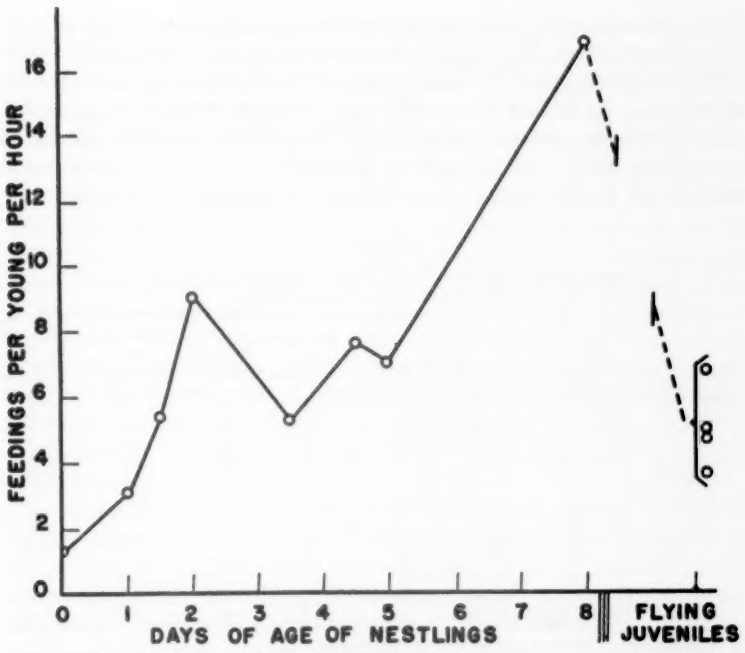

FIGURE 2. Black Tern. Number of feedings per young per hour. Young birds 0 to 8 days of age and flying juveniles.

22, from zero to five days, the adults shared fairly equally in covering the nest. Adult X covered the nest 776 minutes or 43.9 per cent of the time observed, Adult Y 695 minutes or 39.4 per cent. At Nest 1, from one to eight days, parental sharing of this duty was not equal. Adult A covered the nest 122 minutes (8.1 per cent), Adult B, 220 minutes (14.6 per cent).

Feeding.—The greatest part of the food for the young birds was gathered within a radius of a few hundred feet from the nest. The hunting parent flew about above the vegetation, hovered occasionally, and then dropped downward quickly to pick an insect from a stem or leaf. The bird then rose and flew directly to the nest, crying as it went. It dropped to the nest momentarily, or merely hovered above the nest for a fraction of a second to feed one chick, and then flew away to repeat the performance. A few insects were caught from the surface of the water or on the wing, and at times I saw an adult vigorously chasing a zigzagging dragon-fly. Pittman (1927: 140) watched Black

Terns in Saskatchewan which gathered most of their food from plowed ground and, later, from among the growing grain. Bent (1921: 295–297) has given excellent descriptions of food gathering and feeding of young. At Indian River, fish were usually obtained at some distance from the nest and were caught by the typical weak plunge of the Black Tern. Of interest is Murphy's (1938: 177) observation that Black Terns in gray winter plumage wintering in great flocks off

TABLE 4

SUMMARY OF FEEDING RECORDS OF YOUNG IN NESTS AND OF FLYING JUVENILE BLACK TERNS

Nest	*Date (1950)*	*Age of young birds*	*Number of young*	*Minutes watched*	*Number of feedings*	*Feedings per hour per young*
22	July 20	(1 egg) 0-day*	1	316	4	1.24
22	21	(1 egg) 1-day	1	548	28	3.07
1	7	1- and 2-day	3	167	45	5.39
22	22	2-day	1	405	61	9.03
1 and 1†	9	3- and 4-day	3	409	108	5.28
1†	10	4- and 5-day	3	400	152	7.61
22	25	5-day	1	495	57	6.91
1	13	8-day	1	525	147	16.80
	29	flying juvenile	2	240	55	6.35
	30	flying juvenile	2	540	85	4.72
	31	flying juvenile	2	390	59	4.53
	Aug. 8	34-day	1	455	26	3.43

* Hatched 193 minutes before end of this record.
† Auxiliary Nest 1.

the Pacific coast of Colombia fed "by stooping to the surface over areas in which schools of predacious fishes are engaged in carnage." He adds "Never did I see one plunge in the traditional tern manner."

Insects comprised 93.6 per cent of the feedings brought to the nest. Of 602 feedings observed between zero and eight days of age, 78.1 per cent were unidentified insects, 10.3 per cent damsel flies, 2.68 per cent dragon-flies, 2.5 per cent mayflies, 0.02 per cent cicadas (Homoptera), 4.9 per cent fish, and 1.5 per cent unidentified. Because of the hurried, split-second feedings on the wing, it is possible that a small percentage of the food items might have been misidentified as insects when they were crustaceans, arachnids, etc.

I observed a total of 602 feedings of young between zero and eight days of age. On frequent occasions many feedings occurred in a series of one-minute or half-minute intervals. On July 13 at Nest 1, one adult made 53 feedings in 86 minutes (7:44 to 9:10 a.m.) to a single eight-day-old bird. The number of parental feedings per nest, and the mean number of feedings per young per hour are listed accord-

ing to age of young in table 4. A graph (figure 2) drawn from these data illustrates the increase from 1.24 feedings per young per hour for the first 193 minutes after hatching to 16.8 feedings per hour at eight days of age. Between two and five days of age, the feedings fluctuated around a mean of 7.2 per hour and suggest a temporary plateau in the number of feedings for that period. The extremes of the numbers of feedings per young per hour during single observation periods varied as much as four to seven, zero to 27, and two to 37. Often, however, the hours of least feeding on one day were the hours of greatest feeding on another, so that no consistent, clear-cut daily pattern of feedings could be recognized.

Of 150 observed feedings of young between zero and five days of age at Nest 22, Adult X made 67 (44.7 per cent) and Adult Y made 83 (55.3 per cent). Of 452 observed feedings of young between one and eight days at Nest 1, Adult A made 313 (69.3 per cent), Adult B made 100 (22.1 per cent), and 39 (8.6 per cent) were made by an unidentified parent.

Parental care of young between nine and approximately 25 days of age apparently continued as with young from zero to eight days of age, but with much less time spent in covering the nest. I often observed the feeding activities and nest-protecting activities of the adults during this period, but made no detailed records from a blind.

ACTIVITIES OF FLYING JUVENILES

Young Black Terns take wing during July. Tinker (1914: 74) observed the first flying juveniles of the year (Palo Alto County, Iowa) on July 3; Willett (1919: 197) in Harney County, Oregon, saw some flying juveniles on July 20; and Du Bois (1931) watched Black Terns feeding their flying juvenile offspring in Minneapolis during the latter half of July. July 6 was the earliest flying date at Indian River in 1950. Counts of the number of flying juveniles seen at Indian River during daily observations for six to nine hours were as follows: July 6—1, July 8—1, July 11—7, July 16—12, July 18—14, July 19—19, July 20—12, July 26—4, August 4—4, August 8—5, and August 10—3.

Very probably many more young birds were on the wing than these figures show, for there was considerable evidence that some families were feeding in areas hidden by vegetation and thus went unobserved. This was especially true from July 11 to July 20. Many adults and juveniles left the marsh at the same time. On July 26 the marsh was very quiet, and it was then I first realized that large numbers of birds had departed. On that date, I saw only eight adults and five juveniles;

on August 4, ten adults and four juveniles; and on the last trip to the marsh, August 14, only one adult and no juveniles.

In 1951, the earliest flying date was July 5 (one bird). Three flying juveniles were seen the next day. Thereafter, counts were not made until mid-August when it was found that flying juveniles were at the marsh much later than in 1950. Young in flight during daily observation periods for two to five hours were as follows: August 10—2, August 11—8, August 12—5, August 13—10, August 14—8, August 15—5, August 16—7, August 17—5, and August 21—5.

My general observations place the flying age at approximately 25 days. Of the many flying juveniles seen in 1950, only one was recognized as a color-banded individual of known age. This was the single bird from Nest 1. Last observed at the nest on July 14, this bird was flying almost a mile from the nest on August 4, at 30 days of age.

Palmer (1941: 92) wrote that the young Common Terns which he studied in Maine flew from their nests on islands to the nearby beach of the mainland. "Upon arrival, the young separate and each alights on the sand, usually very close to a given spot, where they stand, sometimes for hours, while their parents bring food to them." They were fed thus for four or five days or even longer. At Indian River the young Black Terns flew to some other part of the general nesting area, where a feeding territory containing a few perching stations was established. For the juvenile from Nest 1, there were three perches, two of which were the ends of small logs projecting an inch above the water in a small, shallow bay on the edge of the river channel; the third was a channel-marker post extending six feet above the water. These perches were approximately 100 feet apart. Young birds were seen in many feeding areas along the edge of the river, but only one other area was watched intensively. Two juveniles used the second area, and here there were four perches. One was a small log floating in the bulrushes on the edge of the channel, two were channel posts, and the fourth was a group of water-lily leaves covering an area approximately five feet in diameter. Distances between the perches varied from 25 to 100 feet.

The juveniles spent much of their time standing quietly on one of the perches in a feeding territory, but cried loudly when a calling parent approached with food. The juveniles were strong fliers and at times flew about locally, demonstrating considerable skill in dipping, turning, and hovering. Often they flew low over water, dipping their beaks in the water. Occasionally one picked up a bit of plant material and carried it for a few feet before dropping it back in the water. At times they made the half-hearted plunge typical of adult Black Terns,

a plunge which amounts to little more than dropping to the water and dipping the head beneath the surface. The juveniles sometimes flew away from the feeding areas (alone or with a parent) and out of my field of vision; usually they would be gone for 5 to 15 minutes—once for an hour. I believe that such departures were for trial flights, not for feeding. Juveniles from other areas often flew by, but I never observed them feeding. Indeed, even within their own territories, I saw flying juveniles gathering food only three times: once one caught a small fish and ate it, and once a juvenile on a log reached out and picked small midge-like insects from the water as they floated past. Finally, on August 21, 1951, I watched two color-marked juveniles more advanced than any studied in 1950, having made their initial flight 13 days before, and for 114 minutes they fed continuously on the wing by hovering and picking small insects from bulrush stems. They were still attended by a single parent, which fed them occasionally. Du Bois (1931) described young Black Terns being fed by adults near a boat dock on a lake in Minnesota at a place far from any breeding area. When dead minnows were thrown into the lake by the boat keeper, "Black Terns, young and old, flocked to the spit. The young swooped down upon the floating minnows in the same manner as the old birds, and usually secured a minnow quite dexterously." Palmer (1941: 93) reported an observation (made by A. H. Norton) of juvenile Common Terns fishing as early as August 29.

The young Black Terns were aggressive in defending the feeding area and often joined the parent in chasing strange birds. In one case, two juveniles chased away a Ring-billed Gull (*Larus delawarensis*) when no parent was present.

Parental Care of Flying Juveniles

As I rowed about the nesting area, I observed many groups of flying juveniles in feeding territories. One feeding area was occupied for at least five days. In each case only one parent was seen with the young at any one time, and I believe that the other parent had left the young entirely. This was substantiated by intensive observations of two broods. In 455 minutes of feeding of a juvenile from Nest 1, only one adult appeared, and it was consistently identified by the very distinctive development of the winter plumage. During 19 hours and 48 minutes of observation of a second feeding territory with two young, only one parent was present at any one time. However, in this case the postnuptial molt had just begun, and it is possible—although highly improbable—that there were two adults in the same stage of the molt visiting the feeding area at different times.

The number of feedings per hour was less for a flying juvenile than for an eight-day-old bird. The mean number of feedings per bird per hour was 5.02 during three observations of two juveniles, and 3.43 per hour for one observation of one juvenile (table 4 and figure 2). Of the 225 feedings, at least 12.9 per cent were of small fish. The remainder of the foods were not identified, but presumably they were largely insect material, since the parents exhibited typical insect-gathering activity near by.

AUXILIARY NESTS

Auxiliary nest building was observed at Nest 1 on July 9, 1950, when three birds of three and four days of age were in the nest. From 4:55 until 7:43 a.m., activity at this nest had been normal and 57 feedings had been made. At 7:43 a.m., the young were sleeping while Adult A flew about calling occasionally. At 8:01 a.m., two of the three young suddenly appeared frightened. They left the nest and, by swimming and scrambling over broken bulrushes, progressed three feet to the edge of a 50-foot strip of open water separating the bulrushes from some cat-tails. Here they paused briefly and '*chirred*' noisily; then in response to parental calls, they swam across the open water and five feet back into the thin cat-tails. Both parents hovered above their heads calling, then dropped to a thin log on which the young had climbed and *immediately* began to reach out into the surrounding water and vigorously pull in old, wet plant stems, piling them about the young. At 8:18 a.m., the third young bird left the original nest and, in a few minutes, joined the others at the new nest. From 8:20 to 9:29 a.m., one or the other of the parents occasionally brooded the young or, more frequently, with great fluttering of wings to keep its balance reached out in the water and hurriedly pulled vegetation up around itself and the young. As I watched with a binocular, the parents periodically flew in with food to the '*chirring*' young standing in the new nest. From 9:29 a.m. until 1:30 p.m. the same day, normal feeding followed (52 feedings in 241 minutes), broken at times by brief periods of nest construction.

The next day (July 10) I watched this auxiliary nest from 1:30 until 8:40 p.m.; there was no unusual activity (152 feedings); as darkness fell, Adult B was carefully brooding the three young—rumps out.

On July 13, at 4:30 a.m., I pushed the boat and blind into place at the auxiliary nest, but no young birds or adults came in. I moved the blind to the original nesting site; at 5:15 a.m. one young bird came to the nest, and 147 feedings took place between 5:21 a.m. and 2:00 p.m. the same day. The other two young did not appear, and I did not see them again.

On July 14 I returned to the original nesting site and pushed the boat and blind into place at 2:00 p.m. The young bird (now nine days of age) could be heard '*chirring*' in the bulrushes about 15 feet from the original nest. The adults dropped down in some cat-tails about 30 or 40 feet away (in the opposite direction from the auxiliary nest) and emitted the low, throaty "young-calling" notes. The young bird moved to this point, and the parents then flew an additional 60 feet over the cat-tails and dropped down. During the next half-hour the adults spent most of the time (out of sight) at this spot. Possibly the young bird had moved over to them, and they were building a second auxiliary nest. I did not row in to observe them, as I feared further disturbance would cause them to move again.

Another example of auxiliary nest building occurred at Nest 22. This new nest was built when I was not present and was placed 30 feet from the original nest on an extensive mat of bulrush stems formed when a rowboat had been poled into the area a few days before. The single color-banded young bird had moved to the new nest when it was three to five days of age. This nest, too, was used for brooding, feeding, etc. just as the original nest had been used. In 495 minutes of observation on July 25 when the young bird was five days old, it received 57 feedings.

The final case of auxiliary nest building was that of Nest 24. This new nest was 103 feet from the original one and contained two color-banded young approximately three days of age.

Aggressiveness of Black Terns

The Black Tern is noted for its aggressiveness toward human intruders. A great clamor arose from the parents and other birds near by whenever I visited a nest, but birds varied considerably in belligerence. At some nests the parents flew 20 or more feet above my head calling vigorously; at other nests they circled overhead and repeatedly struck my head or hat, each swoop accompanied by a raucous cry. A few of the birds soon learned to recognize me as an intruder in contrast to local fishermen, and would pass by the fishermen, coming as far as 200 feet from a nest to attack me. This habit proved helpful in capturing birds to band for identification. By means of an insect net with a 33-inch handle, 12-inch hoop, and 21-inch-deep net, it was possible to capture some of the birds as they swooped low at my head. At the height of the nesting season, six particularly pugnacious adults were caught in this manner. One of the six was thus captured three days in succession; when released, it merely shook itself for a few minutes and returned to the attack.

Later in the season the birds could not be caught, with the exception of one which was netted on August 10 while it was feeding some month-old juveniles.

At times, in company with a few Redwings, 10 to 20 Black Terns joined in a flock to mob an animal encroaching on the area. Fluttering overhead, they would follow it noisily across the marsh. At one time the animal being followed came out of the vegetation and into view in the river and proved to be an otter (*Lutra canadensis*). Judging from the great speed with which the flocks moved across the marsh, I suspect that an otter (or otters) was usually the cause of the mobbing. Once a small flock of terns was seen chasing a mink (*Mustela vison*) near the edge of the river, but they stopped as soon as the mink ran into the dense cat-tails. Dr. O. S. Pettingill, Jr., has sent me the following statement: "In the area where you worked I witnessed a group of Black Terns mobbing a water snake (*Natrix sipedon*) and a big snapping turtle (*Chelydra serpentina*) in the same manner you describe."

Areas where juveniles were fed were defended against other birds. During 19 hours and 48 minutes of observation in one feeding area, the one adult made 12 defensive actions: eight against Black Terns, one against some Common Terns, and three against Ring-billed Gulls.

NEST VISITING

Visits of strange Black Terns to nests were observed twice. At Nest 1, when the construction work on the first auxiliary nest was nearing completion, a strange adult—distinguishable as a stranger by the condition of the postnuptial molt—alighted on the nest. A moment later it departed and a second stranger alighted briefly and very gently pecked at the heads of the young birds. The parents were standing on the nest but made no protest. I believe that the visiting birds were from Nest 16 which was 31 feet away.

The second visit of a strange adult to a nest took place during the excitement following the hatching of the first egg at Nest 22. At 12:33 a.m., Adult X alighted and settled on the egg and young bird. Adult Y departed. In a few moments, a *third adult* flew in. The two birds "talked" quietly, then the visiting bird climbed on X's back in copulatory position. Adult X protested mildly and tried to throw it off although continuing to cover the young bird and egg. X stood partly erect; the third bird kept sliding backwards and then walking forward treadmill-like to hold its position. Finally the third bird lowered its belly feathers and under tail coverts in a very brief copulatory gesture and then flew away. Adult X was apparently

only slightly perturbed by this whole sequence, which required two or three minutes.

Dr. O. S. Pettingill, Jr., has told me he saw a strange Black Tern alight briefly on a nest containing three young approximately three days old and attempt to copulate with two of them. First one, then the other squalling young bird was pushed flat on the nest as the bird stood on it. The young were unharmed.

SUMMARY

Nesting habits of Black Terns were studied at the Indian River Marsh in Cheboygan County, Michigan, from June 24 to August 14, 1950, and supplementary observations were made from May 19 to August 22, 1951.

The greatest number of observed fish flights was on May 19 and 20, 1951. Spectacular flock flights of at least 100 birds preparing to nest took place on May 20.

Courtship included posturing and aerial gliding, and both were generally similar to these activities in the Common Tern. However, through the summer, aerial gliding was apparently less frequent than in the Common Tern.

Of 27 nests found in 1950, 17 were in a loose colony; ten were scattered in pairs. All but four of the nests were built on floating platforms and were in water at least two feet deep. Dead vegetation floating about immediately adjacent to the nest platforms was apparently the source of nest material.

In 1950, eggs were laid between June 6 (estimated) and July 1. In 1951, one to three eggs were found in each of 14 nests on May 29. The clutch number was one to three (mean, 2.25, in 1950). Data of Mr. Robert Goodman are reported placing the incubation period at 21 days.

During observations at one nest on the last three days of incubation, the eggs were covered 97.3 per cent of the time. At this nest, one bird (Adult Y) did all of the afternoon and evening incubating (once Y remained on the eggs for 404 minutes except for 14 absences totalling nine minutes). Both parents shared the morning incubation.

Change-overs occurred very quickly although the outgoing bird often pulled in a few stems and piled them about its incubating mate before departing.

The peak period of hatching in 1950 was June 26 to 29, but newly-hatched young were found occasionally until July 20. In 1951, five nests were found with recently hatched young on June 14.

One nest was observed during hatching. Both parents were obviously excited and took part in vigorous nest-reinforcement activity at this time. Once a strange adult attempted to copulate with the brooding parent. An adult flew away with the egg shells.

One young bird accepted food 122 minutes after hatching. Young almost always left the nest as I approached, but returned after I had settled in the blind. As they matured, such frightened birds swam farther out, and it became progressively more difficult for the parents to call them back to the nest. Young birds always defecated in the water.

Parents shared in covering young in the nest. At hatching, one nest was covered 99.0 per cent of the time. Thereafter, time covering the nest decreased rather regularly to 6.1 per cent at eight days of age.

From zero to eight days of age, the combined feedings from two nests were 93.6 per cent insect, 4.9 per cent fish, and 1.5 per cent unidentified. Most insect food was gathered from the stems and leaves of marsh vegetation near the nest. The number of feedings per young per hour during this time increased from 1.2 to 16.8. At one nest, one parent made 44.7 per cent of the feedings, the other 55.3 per cent. At the second nest, one parent made 69.3 per cent of the feedings, the other 22.1 per cent, and 8.6 per cent were made by an unidentified adult.

Juveniles took flight at approximately 25 to 30 days of age. First flying dates were July 6, 1950 and July 5, 1951. The largest numbers were seen in flight in 1950 from July 16 to 20, and by August 14 all had apparently left the area. In 1951, five juveniles still remained on August 21.

As juveniles first took flight, each brood (one to three birds) became established in large, defended feeding territories with three or four perches. Here a parent fed them. Once, two young were still being fed in such a territory 13 days after taking flight, although also catching food themselves. Food brought to flying juveniles was at least 12.9 per cent fish. Other food was unidentified but probably consisted of insects. Feedings numbered 5.0 per juvenile per hour in one case, 3.4 in another.

In three cases, parents built new ("auxiliary") nests at 30, 53, and 103 feet, respectively, from the original nest. The new nests were used as the original nests had been.

The adults were extremely aggressive toward intruders on the nesting area.

Strange adults visited nests in two instances.

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THE STRUCTURE OF THE CLOACAL PROTUBERANCE OF THE VESPER SPARROW (*POOECETES GRAMINEUS*) AND CERTAIN OTHER PASSERINE BIRDS

W. RAY SALT

WHEN collecting passerine birds it has long been my custom to sex them in the field by an external examination of the cloacal region. In males this region swells considerably prior to the breeding season to form a definite protuberance. The organ persists throughout the breeding season after which it regresses and disappears. Its use as a diagnostic characteristic for sex is therefore confined to the breeding season, but at that time it is particularly useful in sexing those sparrows in which there is no sexual dimorphism. The fact that ornithologists of my acquaintance were not familiar with this organ, and the lack of reference to it in most treatises and papers on the avian reproductive system, suggested a study of its structure as a preliminary to further investigation.

HISTORICAL REVIEW

Fatio (1864) noted the protuberance on *Accentor alpinus* [=*Prunella collaris*]. Gadow and Selenka (1891: 837) state that it reaches its highest state of development in the Alpine Accentor and in the African genus *Textor*. Stresemann (1934) mentions the protuberance on the American Robin (*Turdus migratorius*) and on the Red-eyed Towhee (*Pipilo erythrophthalmus*). Rowan (1929) failed to notice it on the Slate-colored Junco (*Junco hyemalis*). No mention of a protuberance on the English Sparrow (*Passer domesticus*) is made by Keck (1934), Riley (1937, 1938), Witschi (1936, 1945), or Witschi and Woods (1936). Witschi (personal communication), however, says that he noticed it but considered it an edematous condition. The sex organs of the Starling (*Sturnus vulgaris*) have been the subject of investigations by Bullough (1942), Bissonnette (1930a, b, 1931, 1936) and Witschi (op. cit.). Bullough's work in particular treats in great detail all parts of the reproductive system of both male and female; but, in common with the other writers, he says nothing of a protuberance of the cloacal region of the breeding male. Drost (1938) found the protuberance on the English Sparrow, the Starling, and several other species of European passerine birds. Blanchard (1941) and Blanchard and Erickson (1949), in their works on the White-crowned Sparrow (*Zonotrichia leucophrys*) also failed to mention this region. In the present studies a cloacal protuberance has been observed on breeding males of the Slate-colored Junco, the English Sparrow, the White-crowned Sparrow, and other passerines.

MATERIALS AND METHODS

Specimens were collected with fine shot and were examined immediately in the field and later in the laboratory. Parts required for microscopic study were removed in the field and fixed in Bouin's fluid. Serial sections of cloacal protuberances were cut at 20 microns, and from one set a wax-plate model was made by using camera lucida templates. Other sections were cut at various thicknesses and stained with Delafield's haematoxylin and eosin, Mallory's connective tissue stain, or Weigert's elastic tissue stain. Freshly-killed specimens were dissected in the laboratory, and drawings were made from such dissections.

Although the primary subject of this investigation was the Vesper Sparrow, parallel studies were made on the Horned Lark (*Eremophila alpestris*) and the Chestnut-collared Longspur (*Calcarius ornatus*). The Clay-colored Sparrow (*Spizella pallida*), Brewer's Blackbird (*Euphagus cyanocephalus*), the Purple Grackle (*Quiscalus quiscula*), and the Black and White Warbler (*Mniotilta varia*) were studied less intensively. Since starting this investigation, I have collected no passerine species on which some indication of a cloacal protuberance was lacking on the breeding male. Conversely, no non-passerine species has been collected on which a cloacal protuberance was evident (figure 3). In addition to the above-mentioned passerines, I have observed the cloacal protuberance on the following species: Robin (*Turdus migratorius*), Yellow-throat (*Geothlypis trichas*), House Sparrow (*Passer domesticus*), Western Meadowlark (*Sturnella neglecta*), Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*), Redwing (*Agelaius phoeniceus*), Cowbird (*Molothrus ater*), Spotted Towhee (*Pipilo maculatus*), Savannah Sparrow (*Passerculus sandwichensis*), Leconte's Sparrow (*Passerherbulus caudacutus*), Sharp-tailed Sparrow (*Ammospiza caudacuta*), Slate-colored Junco (*Junco hyemalis*), White-crowned Sparrow (*Zonotrichia leucophrys*), and McCown's Longspur (*Rhynchophanes mccowni*).

STRUCTURE OF PROTUBERANCE

In form, the cloacal protuberance appears as a spherical appendage on the Vesper Sparrow, the Clay-colored Sparrow, and the Sharp-tailed Sparrow (figure 2). On the Horned Lark, it has a cylindrical or truncated-conical form (figure 4). Present data are insufficient to show whether the shape of the protuberance is similar within taxonomically defined groups other than species. Changes in size and shape naturally occur during development and regression of the in-

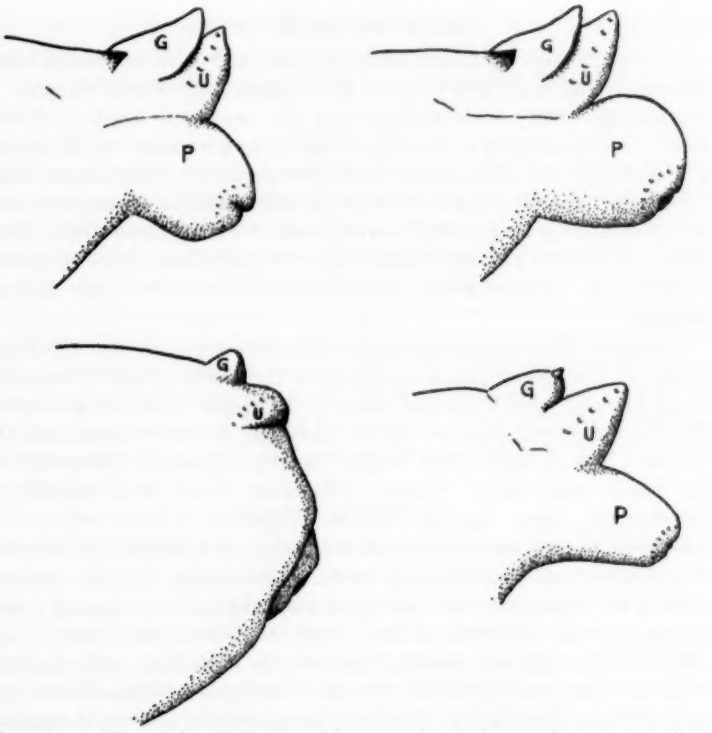

FIGURE 1. *Upper left.* Cloacal protuberance of male Vesper Sparrow, not fully developed. (Specimen 121, Calgary, Alberta, May 14, 1947.) × 2.

FIGURE 2. *Upper right.* Fully developed cloacal protuberance of male Vesper Sparrow. (Specimen 129, Calgary, Alberta, June 1, 1947.) × 2.

FIGURE 3. *Lower left.* Cloacal region of male Pectoral Sandpiper (*Erolia melanotos*) showing no evidence of protuberance. (Specimen 124, Calgary, Alberta, May 17, 1947.) × 2.

FIGURE 4. *Lower right.* Fully developed cloacal protuberance of male Horned Lark. (Specimen 135, Calgary, Alberta, June 21, 1947.) × 2. (G—Preen gland; U—Uropygium; P—Cloacal protuberance.)

dividual organ, but variations in the fully-developed protuberance within a species are minute.

In male Vesper Sparrows during the breeding season, the region immediately surrounding the cloaca protrudes postero-ventrally carrying the anus several millimeters from its original position. A roughly spherical body, slightly flattened on its ventral surface, is thus formed (figures 1 and 2). Its greatest diameter is about 10 mm. On the

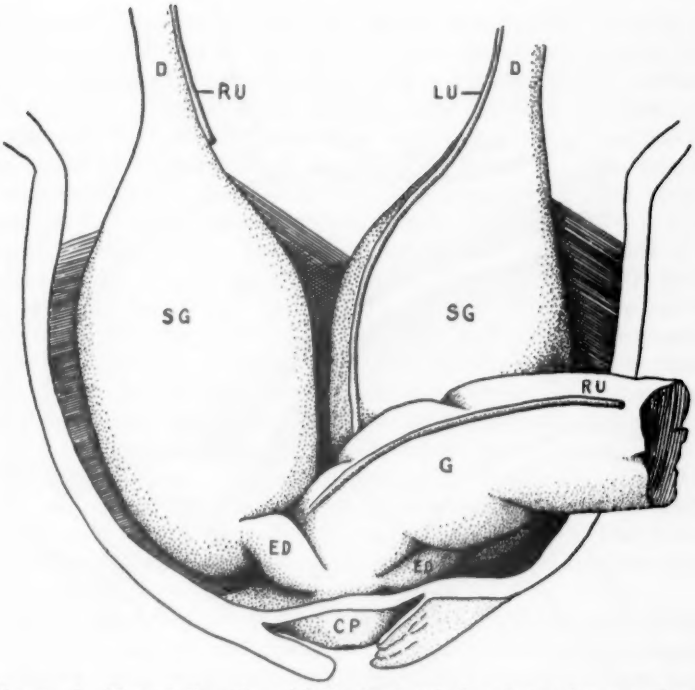

FIGURE 5. Ventral dissection of fully developed cloacal protuberance of male Vesper Sparrow. Gut displaced to left, fat and connective tissue removed to show major organs. × 8. (C.P.—Cloacal papilla; D.—Ductus deferens; R.U., L.U.—Right and left ureters; S.G.—Seminal glomus; G.—Gut; E.D.—Ejaculatory duct.)

distal surface is the anal opening encircled by thickened lips. The lips are often open, exposing the anterior wall of the proctodaeum which forms a smooth papilla on whose surface is the aperture of the urodeum (figure 2).

Upon dissection the protuberance is found to contain the ends of the digestive tract, the genital ducts, and the ureters (figure 5). Connective tissue and fat fill the interstices. The digestive tube occupies a median ventral position. Along its dorsolateral surfaces run the ureters. Extending dorsally and laterally over the digestive tube and filling the remainder of the protuberance are two large pear-shaped bodies formed of the coiled ends of the gonaducts. Though they are in contact in a median line, they remain distinct within their separate sheaths of connective tissue. To their proximal ends the deferent ducts lead and from their distal surfaces come a pair of large

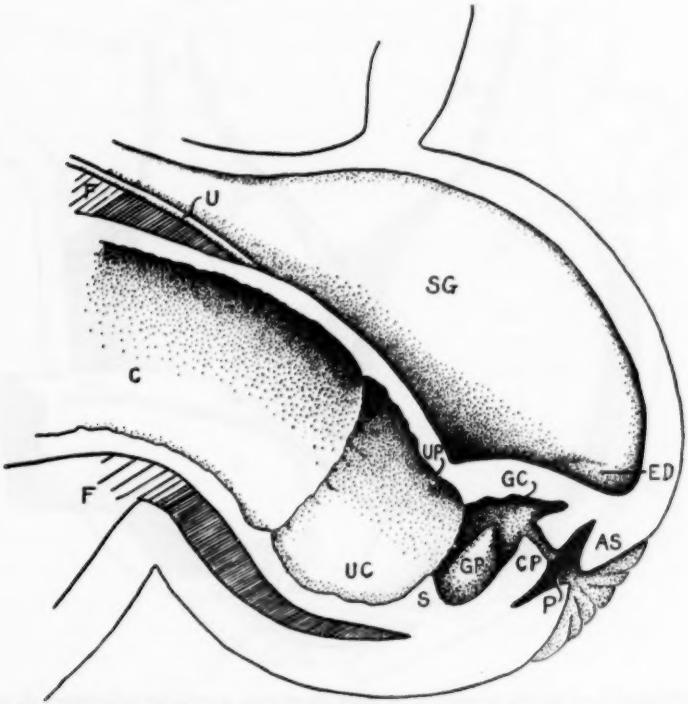

FIGURE 6. Right half of fully developed cloacal protuberance of Vesper Sparrow. × 8. (A.S.—Anal sphincter; C.—Coprodeum; C.P.—Cloacal papilla; E.D.—Ejaculatory duct; F.—Connective tissue and fat; G.C.—Genital chamber of urodeum; G.P.—Genital papilla; P.—Proctodeum; S.—Sphincter separating urinary and genital chambers; S.G.—Seminal glomus; U.—Ureter; U.C.—Urinary chamber of urodeum; U.P.—Urinary papilla.)

muscular ejaculatory ducts which pass ventrally around the cloaca to enter it from the ventral surface.

The coprodeum, the anterior cloacal chamber, contains no elements of the reproductive system. The urodeum is divided by low folds of its walls into two chambers. The anterior, urinary chamber (figure 6, U.C.) is a short compartment on whose roof the ureters open on two minute papillae. The mucosa of this chamber is thrown into low irregular folds and contains short tubular glands. The lamina propria is rich in lymphoid tissue, small nodules being quite numerous. The submucosa and tunica muscularis are thin. A short distance posterior to the openings of the ureters, the tunica muscularis is

strengthened by a strong sphincter muscle which causes the wall to protrude into the cavity (figure 6, S). This sphincter separates the urinary chamber of the urodeum from the succeeding genital chamber.

The genital chamber of the urodeum (figure 6, GC) is a short, irregular chamber extending back to the sphincter of the cloacal papilla over which its cavity extends dorsally and laterally. No evidence of a vestigial bursa of Fabricius has been observed in adult males. From the floor of the chamber two long conical papillae (figure 6, GP) project into its cavity. They arise close together on each side of a median line and reach dorsally toward the cloacal opening. On their tips open the ejaculatory ducts. With the closing of the sphincter immediately anterior to them they are forced back close to the urodeal opening through the cloacal papilla so that the ejaculate may be emitted through the urodeal opening with a minimum of obstruction. About midway in this chamber on a line running up the genital papillae to their tips the epithelium changes abruptly from a columnar to a stratified type, the anterior half of the genital chamber and papillae thus being covered with simple columnar glandular epithelium while the posterior half is covered with stratified epithelium. This latter type of epithelium extends back through the urodeal aperture into the proctodeum.

The proctodeum (figure 6, P) extends posteriorly from the muscular cloacal papilla to the anal opening. Its walls, including the cloacal papilla, are supplied with striated muscle and voluntary control may be assumed. The mucosa is of stratified epithelium on whose surface short simple tubular glands open. As elsewhere throughout the cloaca, lymphoid tissue, scattered or in discrete nodules, is present in the lamina propria and submucosa. During coition the proctodeum may be partially everted, the cloacal papilla being carried through the anal opening. The lips surrounding the anal opening are drawn back to facilitate this process.

During May and June the seminal glomera are the largest and most obvious organs in the cloacal protuberance of the Vesper Sparrow. They are slightly flattened, pear-shaped bodies about 8 mm. long, 4 mm. wide and 4 mm. deep. According to Bullough (1942) these organs in the Starling consist of the much-coiled posterior ends of the vasa deferentia together with a number of blind pouches of the vasa. He calls the organs seminal vesicles. He attributes their increase in size during the spring not only to a lengthening and widening of the gonaducts but also to an increase in number and size of these blind pouches. Witschi (1945) on the other hand, working with the same species, finds no branches of the gonaducts and calls their coiled ends

glomera. During the present work ten of these organs from the Vesper Sparrow were teased apart and each proved to be a continuous duct with no diverticulae or pouches. Serial sections of others were examined and in no instance could a branching of the duct be found. This was also true for similar organs taken from the Horned Lark, the Chestnut-collared Longspur, and Brewer's Blackbird. In each case, the end of the vas was an unbranched, much-coiled body which may best be termed a seminal glomus. Fatio (1864) says that in the Alpine Accentor, the uncoiled duct would be at least one meter long. In the Vesper Sparrow, it is estimated to be about 80 cm. long.

In the Vesper Sparrow the lumen of the glomeral duct when filled with spermatozoa varies from 150 to 315 microns in diameter, the average being about 250 microns. There appears to be no regularity in the variation. It is probably caused by temporary congestion of semen in certain parts of the duct. The lining epithelium is of a low columnar type. Referring to that of the Starling, Bullough (1942) says that these cells "were seen to be ciliated and very actively secreting." In the Vesper Sparrow, the epithelium shows ample evidence of secretion of an apocrine type, the inner surfaces of the cells being drawn out into beads as their ends are pinched off in the secretory process. No cilia, however, were noticed. The tunica of the duct contains both connective tissue and smooth muscle. In the proximal coils, these tissues are intermingled, but farther down the duct a thin inner sheath of connective tissue and an outer muscular sheath become distinct. The connective tissue contains collagen fibers and a small amount of elastic fiber. The interstices between the coils of the glomeral duct contain loose connective tissue in which run many small blood vessels and capillaries.

At the distal end of each glomus, the duct becomes more muscular and more regularly circular in section as it gradually forms the ejaculatory duct. The lumen becomes reduced as the walls thicken. The ejaculatory duct becomes distinct from the glomus at its distal end and makes a single forward loop as it travels a distance of about three millimeters to the ventral wall of the cloaca, the entrance to which has been previously described. The lining epithelium of columnar cells is thrown into longitudinal ridges indicating that the duct is distensible. Its tunica is very thick and consists mainly of smooth muscle with a small amount of connective tissue. No elastic fiber is present. The papillae on which these ejaculatory ducts open in the genital chamber of the cloaca are merely free extensions of the duct. They are approximately 1.2 mm. in length and 0.5 mm. in diameter. Two large ganglia lie dorsal to the cloaca near the ends of the ureters.

From visual evidence only, I believe post-ganglionic fibers from these ganglia innervate the glomeral ducts.

REGRESSION OF PROTUBERANCE

Following the breeding season, the protuberance becomes smaller. In specimens taken at the end of August, it had almost disappeared. Owing to the migratory habit of the Vesper Sparrow, no specimens were available after this time, and it is not known whether or not there is further regression during fall and winter months.

Within the protuberance changes occur mainly in the glomeral ducts. These shorten and become thinner causing the glomera to become reduced in size. The ejaculatory ducts and the genital papillae are also greatly reduced. By the middle of July, the walls of the glomeral duct have become apposed in many places and the lumen disappears or is greatly reduced. The epithelium has become cuboidal or occasionally squamous. The connective tissue coat is more fibrous, and the wall of the duct is relatively thicker. The interstitial tissue has also become more dense, and it is difficult to define the duct in some places. By the end of August these changes have progressed until the lumen of the duct has disappeared and the glomus appears as a tightly wound cord firmly embedded in connective tissue.

DISCUSSION

This study indicates that as a result of the growth of those parts of the gonaducts known as the seminal glomera, an external protuberance is produced at the cloacal region of the Vesper Sparrow and certain other passerine birds. This protuberance is largest at the height of the breeding season when the seminal glomera are largest. However, the protuberance is something more than a hernia caused by the enlarging glomera; the whole end of the gut tract accompanies it as it develops. This is possibly caused by the close attachment of the glomera and the ejaculatory ducts to the end of the gut. As the glomera lengthen, the ejaculatory ducts are forced distally and the end of the gut follows them. In this manner, the whole of the cloacal region is pushed out to form the cloacal protuberance.

It is not known that the development of the protuberance is synchronous with that of the testes. Indeed, observations made during this study indicate that the growth of the protuberance may lag behind that of the testes. Witschi (1945) has shown that growth of the gonaducts is dependent upon the production of hormones and spermatozoa by the testes. In the Starling, he finds that the cycle of development of the gonaducts is closely linked with the cyclical de-

velopment of the testes "with a slight lag at the beginning." If a similar relationship can be assumed for the Vesper Sparrow, a correlation in size of the testes and the cloacal protuberance must exist at all times, and the development of each could be estimated from the size of the other. Thus an external appendage, the cloacal protuberance, would serve as an indicator of sexual development in a male bird.

The measurement of sexual development in living birds without the necessity of mutilation or sacrifice of the experimental animal has long posed a problem to those who work on the avian reproductive cycle. Witschi and Woods (1936) used the bill color of the English Sparrow as an indicator for the male sex hormone, but the difficulty of measuring fine gradations of color limited the value of this feature. The cloacal protuberance undergoes a development whose range may be even greater than that of the testes and which lends itself readily to biometric methods. The necessary work required to show to what extent the cloacal protuberance may be used as an external indicator of testicular development has not yet been completed.

SUMMARY

A protuberance of the cloacal region has been observed during the breeding season on several species of passerine birds.

The cloacal protuberance of the Vesper Sparrow is described and a histological description of its major components is given.

The development of the protuberance is believed to be caused by the development of the seminal glomera.

It is suggested that the cloacal protuberance can be used as an external indicator of sexual development in some passerine birds.

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Department of Anatomy, University of Alberta, Edmonton, Alberta, December, 1951.

THE SEVENTY-FIRST STATED MEETING OF THE AMERICAN ORNITHOLOGISTS' UNION

BY ALBERT WOLFSON, SECRETARY

THE fourth meeting of the Union in the State of California was held in Los Angeles, October 21 through 25, 1953, at the invitation of the Los Angeles County Museum and the Southern Division of the Cooper Ornithological Society. Headquarters were in the Ambassador Hotel. Business sessions were held in the Ambassador Hotel, the Los Angeles County Museum, and the Hancock Foundation Auditorium on the campus of the University of Southern California; public sessions were held in the Hancock Auditorium.

BUSINESS SESSIONS

Business sessions were held as follows: (1) First Session of the Council, Wednesday, October 21, 9:10 a.m. to 12:30 p.m. Number in attendance, 15. (2) Second Session of the Council, Wednesday, 1:50 p.m. to 3:55 p.m. Number in attendance, 14. (3) Meeting of the Fellows, Wednesday, 4:20 p.m. to 5:15 p.m. Number in attendance, 26. (4) Third Session of the Council, Wednesday, 5:20 p.m. to 6:00 p.m. Number in attendance, 15. (5) Meeting of the Fellows and Members, Wednesday, 8:40 p.m. to 11:50 p.m. Number in attendance, 46 (Fellows, 26; Members, 20). (6) Fourth Session of the Council, Thursday, October 22, 8:15 a.m. to 9:45 a.m. Number in attendance, 14. (7) Second Session of the Fellows and Members, Saturday, October 24, 9:15 a.m. to 9:20 a.m. A quorum was present. (8) Second Session of the Fellows, Saturday, October 24, 1:45 p.m. to 1:50 p.m. Number in attendance, 13.

Reports of Officers. The Secretary reported that the total membership of the Union was 2,900, as of October 21, 1953. This was a decrease of 543 compared with last year. Membership by classes was as follows: Fellows, 75; Fellows Emeriti, 2; Honorary Fellows, 16; Corresponding Fellows, 64; Members, 181; Associates, 2,539; and Student Members, 23. Associates elected during the year totaled 284. Vacancies in the classes of membership which are limited in number were as follows: Honorary Fellows, 4; Corresponding Fellows, 11; Fellows, 0; and Members, 19. The total number of Fellows is 75 (50 Fellows under and 25 Fellows over 65 years of age). Deaths during the year totaled 27, the same as last year, and were distributed as follows: Fellows, none; Honorary Fellows, none; Corresponding Fellows, 4; Members, none; Honorary Life Member, 1; Life Associates, 4; Honorary Life Asso-

ciates, 4; Associates, 14. The Secretary received from Dr. A. W. Schorger, Chairman of the Committee on Biography, notices of the death of the following:

Stephen T. Bivins, Associate, May 2, 1953, at Milledgeville, Georgia.
Charles Anaultus Bruun, Life Associate, August 25, 1943, at Kansas City, Missouri.
Prince Francesco Chigi, Corresponding Fellow, July 2, 1953, at Rome, Italy.
Charles Thomas Church, Associate, February 15, 1953, at New York City.
Albert Ernest Colburn, Honorary Life Associate, January 16, 1953, at Los Angeles, California.
John M. Davis, Associate, May 8, 1952, at Redwood City, California.
Elaine (Mrs. Howard) Drew, Associate, December 22, 1952, at Barre, Vermont.
Charles Dupond, Corresponding Fellow, November 20, 1952, at Laken, Belgium.
Alva Howard Felger, Honorary Life Associate, September 15, 1952, at Denver, Colorado.
Homer Lenoir Ferguson, Life Associate, March 14, 1953, at Warwick, Virginia.
William Lovell Finley, Honorary Life Member, June 29, 1953, at Portland, Oregon.
James Rhoads Gillin, Associate, March 25, 1952, at Wilmington, Delaware.
Masauji Hachisuka, Corresponding Fellow, May 14, 1953, at Tokyo, Japan.
Clifford E. Hope, Associate, August 9, 1953, at Toronto, Canada.
Harry Leon Kutz, Associate, December 25, 1952, at Philadelphia, Pennsylvania.
Zell Charlotta Lee, Associate, June 23, 1953, at Sioux City, Iowa.
Herbert Raphael Mills, Associate, June 27, 1952, at Tampa, Florida.
Leon Nelson Nichols, Associate, August 3, 1953, at New York City.
Juliette Amelia Owen, Life Associate, October 25, 1943, at St. Joseph, Missouri.
George Lewis Perry, Associate, July 31, 1952, at Winchester, Massachusetts.
John McFarlane Phillips, Associate, September 8, 1953, at Pittsburgh, Pennsylvania.
Samuel Nicholson Rhoads, Life Associate, December 27, 1952, at Blackwood, New Jersey.
Leonora Jeffrey Rintoul, Corresponding Fellow, May 22, 1953, at Largo, Scotland.
William Jones Serrill, Associate, May 22, 1952, at Haverford, Pennsylvania.
Clark Perkins Streator, Honorary Life Associate, November 28, 1952, at Santa Cruz, California.
Henry Hotchkiss Townshend, Associate, May 10, 1953, at New Haven, Connecticut.
Addison Prentiss Wilbur, Honorary Life Associate, August 25, 1949, at Canandaigua, New York.

The Treasurer read his report, which will be published in a later issue of 'The Auk.'

Dr. Robert W. Storer, Editor of 'The Auk,' reported on matters of policy and forthcoming issues. Since 'The Auk' is a permanent record of research accomplished and facts discovered, papers submitted for publication will be judged primarily for their future value and secondarily for their present interest. This policy will also apply to the section on general notes and should result in a change in emphasis from records of occurrence to information on the habits and biology of birds. He made it clear that distributional data are important and will continue to be published, especially notes which

summarize several apparently related records. Dr. Storer discussed the weaknesses of the present systems of abstracting the recent literature and preparing the annual and decennial indexes and made suggestions for improving them. Material on hand, and scheduled for 1954 issues of 'The Auk,' includes papers on the Sooty Terns of Ascension Island, the pairing behavior of the Cliff Swallow, energy balance in the English Sparrow, and the rediscovered Brazilian Merganser (*Mergus octosetaceus*).

Reports of Committees. The Chairman of the Committee on Endowment, Mrs. Betty Carnes, reported the following results: Life Members, $1,500.00; partial payments of prospective Life Members, $604.00; partial payments of prospective Patrons, $1,100.00; donations to the endowment fund, $910.29—a total endowment increase of $4,114.29. Contributions to current expenses totaled $775.00, thereby making a grand total of $4,889.29, obtained by the Committee. Through the efforts of this Committee, under the Chairmanship of Betty Carnes, the endowment of the Union was increased by $7,559.29 during the past 2 years. (This does not include $1558.30 which was transferred from the Canadian Account in 1952.)

The report of the Special Canadian Committee was given by Mr. Hoyes Lloyd, Chairman. The work of this Committee was concluded on February 27, 1953, with the transfer of all funds to the Treasurer, and the Committee was discharged. The Council, in accepting the Committee's report, expressed its thanks to Mr. Lloyd for his great service to the Union as Chairman of this Committee during its several years of existence.

Dr. Alexander Wetmore, Chairman of the Committee on Classification and Nomenclature of North American Birds, reported that the Committee has prepared in draft form a revision of the ranges of the remaining part of the family Fringillidae, to cover those species from the genus *Arremonops* to the end. The material went out to collaborators for criticism in four sections, the information being very extensive because of the large number of subspecies to be covered. During the year the Committee gave formal consideration to 42 cases which covered proposals for change in name or status, descriptions of new races, revivals of forms not currently recognized, and records of extralimital birds. Twenty-one changes, corrections, and additions have been published in the Twenty-eighth Supplement of the American Ornithologists' Union Check-List of North American Birds, which appeared in 'The Auk' for July, 1953. The services of Mr. E. M. Reilly, in the employ of the Committee for the assembly of range material from the files of the Fish and Wildlife Service and from other

sources, continued until February 13, 1953, when his work on the final species in the family Fringillidae was completed. Following Mr. Reilly's appointment to a position in the New York State Museum at Albany in October, 1952, the Committee was assisted materially through the cooperation of Dr. Ralph Palmer, of that institution, who permitted Mr. Reilly to carry forward some of the work as a part of his usual duties in addition to the hours outside official time for which he was paid from funds provided by the Smithsonian Institution. Mr. Reilly's work for the Committee began June 15, 1948, and terminated, as indicated above, when his part of the task was completed. The grants of funds from the Smithsonian Institution through the course of the work have amounted to a total of $15,743.51. In addition, the typing, mimeographing, and mailing of the range material to the collaborators, other mimeographed lists, and considerable correspondence have been contributed by the Smithsonian Institution through the offices of the Chairman and Vice-Chairman. Work has begun on preparation of the final manuscript, but it cannot be determined at this time when this will be ready for publication.

Dr. Albert Wolfson, Chairman, reported that the Committee on Research has submitted a list of unpublished theses in ornithology to the Editor for publication in 'The Auk.' The manuscript for the book on recent studies in avian biology has been completed and has been accepted for publication by The University of Illinois Press with the proviso that the Union guarantee at least half the cost of publication. The Council voted to support this project and approved the solicitation of advance subscriptions as a means of meeting this guarantee. The book is expected to appear in the late fall of 1954.

Following the procedure of previous years, the Committee on Student Membership Awards, under the Chairmanship of Dr. William H. Behle, distributed application blanks for student membership awards to 90 regional representatives. Dr. Behle reported that 23 applications were received. Since sufficient funds were available, all applications were granted. The list of recipients was published in the April (1953) issue of 'The Auk.'

Mr. C. K. Nichols, Editor of the '10-Year Index to The Auk,' reported that the manuscript is expected to be ready for checking and copy reading early next year.

Work on the 'Handbook of North American Birds,' sponsored by the Union, with Dr. Ralph S. Palmer as Editor, is progressing. One of the present major problems is the financing of this extensive work. Dr. Palmer discussed a number of possible solutions with the members

of the Council and other interested persons. It is clear that some solution will need to be found soon if the work on the 'Handbook' is to continue.

The Award of the Brewster Medal. The 1953 Brewster Medal was awarded, by action of the Council, to Dr. Hildegarde Howard (Mrs. H. Anson Wylde) for her series of papers on fossil birds dealing with basic research in avian palaeontology. The report of the Committee states: "Her papers in 'The Auk' and 'The Condor' deal especially with material from Fossil Lake, Oregon, and southern California horizons, while a longer and more philosophical paper in 'The Ibis' presents a summary of our current knowledge of the evolution of birds. All are important contributions to scientific ornithology, and the Committee was pleased to recognize both the work of the woman and the essential role in ornithology of competent work in avian palaeontology."

Next Stated Meeting. Fellows and Members, meeting together, accepted the invitation of the University of Wisconsin to hold the Seventy-second Stated Meeting in Madison, Wisconsin. The Council recommended that the Meeting be held early in September if possible. Dr. A. W. Schorger, Chairman of the Local Committee on Arrangements, has notified the Secretary that the Meeting will be held September 8 through 12. Invitations were also received from several organizations in Boston and from the Denver Museum of Natural History. The Council recommended that the Seventy-third Stated Meeting be held in Boston in 1955 and the Seventy-fourth Stated Meeting be held in Denver in 1956. This recommendation was accepted by the Fellows and Members.

Amendments to the By-Laws. Two amendments to the By-Laws were proposed. They were approved by the Council and the Fellows. These amendments are as follows: (1) The name of the class of membership which is now called "Associates" be changed to "Members"; (2) The name of the class of membership which is now called "Members" be changed to "Elective Members." These amendments would necessitate changing the By-Laws only to incorporate these new names as follows: Art. I, Sects. 1, 6, 7; Art. II, Sects. 1, 3; Art. III, Sects. 2, 4; Art. IV, Sects. 1, 3, 4, 6, 7, 8, 9, 11, 12; Art. V, Sects. 1, 3, 5, 7. Final action will be taken by the Fellows in 1954.

Miscellaneous Matters. Mrs. Marcia B. Tucker, at the invitation of the Secretary, donated $250.00 to help a student attend the Stated Meeting in Los Angeles. The officers designated this contribution as the "Marcia B. Tucker Student Award in Ornithology." The Secretary solicited applications from many persons, and seven applications were received. The Award was made by the officers to Christopher M. Packard of Brunswick, Maine.

At the Meeting last year in Baton Rouge, the Council voted to change the name of the Committee on Bird Protection to the Advisory Committee on Bird Protection. Although all Committees of the Union are clearly advisory to the Council, this action was taken to emphasize the fact that members of the Union who are active in matters of bird protection cannot act in behalf of the Union without the approval of the Council. The scope, activities, and responsibilities of the Committee remained unchanged. In view of the great misunderstanding which arose as a result of this action, the Council voted this year to delete the word "Advisory" from the title of this Committee. The Committee presented two reports to the Council; both of them were approved and have been submitted to the Editor of 'The Auk.'

The Council voted that the A.O.U. become affiliated with the American Association for the Advancement of Science (A. A. A. S.) and become an Affiliate Society of the American Institute of Biological Sciences (A. I. B. S.).

ELECTION OF OFFICERS

The following officers were elected for 1953–54: *President*, Alden H. Miller; *Vice-Presidents*, Ludlow Griscom and Ernst Mayr; *Secretary*, Harold Mayfield; *Treasurer*, Charles G. Sibley. *Elective Members of the Council*: John T. Emlen, Jr., A. W. Schorger, Albert Wolfson.

The Council re-elected Robert W. Storer, *Editor* of 'The Auk'; Frederick V. Hebard (Chairman), G. Ruhland Rebmann, Jr., and Phillips B. Street, *Investing Trustees.*

ELECTION OF FELLOWS AND MEMBERS

FELLOWS—3

W. Lee Chambers, Topanga, California.
John Roy Pemberton, Los Angeles, California
Francis Marion Weston, Pensacola, Florida.

HONORARY FELLOW—1

Ernst Schüz, Stuttgart, Germany.

CORRESPONDING FELLOWS—2

Edward M. Nicholson, London, England.
Ludwig Schuster, Hessen, Germany.

MEMBERS—13

Paul Herbert Baldwin, Fort Collins, Colorado.
Frederick Milton Baumgartner, Stillwater, Oklahoma.
Alexander William Blain, Grosse Pointe Park, Michigan.
John Davis, Monterey County, California.
Miguel Alvarez del Toro, Tuxtla Gutierrez, Chiapas, Mexico.

Keith Lee Dixon, College Station, Texas.
Henry Sheldon Fitch, Lawrence, Kansas.
Gordon W. Gullion, Boulder City, Nevada.
Thomas Raymond Howell, Los Angeles, California.
Carl Buckingham Koford, Berkeley, California.
Robert Allen Norris, Berkeley, California.
Kenneth Carroll Parkes, Pittsburgh, Pennsylvania.
Kenneth E. Stager, Los Angeles, California.

ATTENDANCE

Registration at the meeting showed an attendance of 140 members, composed of 1 Corresponding Fellow, 26 Fellows, 30 Members, and 83 Associates. Among the members present were also the following three Patrons: Betty Carnes, Hoyes Lloyd, and Mrs. Dayton Stoner. Represented were 23 states, the District of Columbia, two provinces of Canada (British Columbia and Ontario), Hawaii, India, and Venezuela. Attendance of 81 guests brought the total registration to 221. Registration at recent meetings at which a fee has been charged has been as follows: 1950, Minneapolis and St. Paul—270; 1951, Montreal—262; 1952, Baton Rouge—288.

CORRESPONDING FELLOWS, FELLOWS, MEMBERS, AND ASSOCIATES PRESENT

CORRESPONDING FELLOW:—Sálim A. Ali, Bombay, India.

FELLOWS:—Dean Amadon, Alfred M. Bailey, William H. Behle, Jean Delacour, Herbert Friedmann, James C. Greenway, Ludlow Griscom, Hildegarde Howard, Frederick C. Lincoln, Hoyes Lloyd, George H. Lowery, Jr., Alden H. Miller, Loye Miller, Robert T. Moore, James A. Munro, William H. Phelps, Frank A. Pitelka, S. Dillon Ripley, A. W. Schorger, Lester L. Snyder, Alexander Sprunt, Jr., Herbert L. Stoddard, Sr., Robert W. Storer, Josselyn Van Tyne, Alexander Wetmore, Albert Wolfson.

MEMBERS:—Anders H. Anderson, John H. Baker, Howard L. Cogswell, John Davis, Keith L. Dixon, E. Thomas Gilliard, Earle R. Greene, Donald R. Griffin, Frederick V. Hebard, Thomas R. Howell, Laurence M. Huey, Junea W. Kelly, Carl Koford, Seth H. Low, Joe T. Marshall, Jr., Robert M. Mengel, Robert C. Miller, Gale Monson, R. Allyn Moser, Robert J. Niedrach, Robert T. Orr, Ralph S. Palmer, Allan R. Phillips, Karl Plath, Charles G. Sibley, Kenneth E. Stager, Wendell Taber, Harrison B. Tordoff, Laidlaw O. Williams, Lloyd R. Wolfe.

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PUBLIC SESSIONS

Five public sessions were held, two on Thursday, one on Friday, and two on Saturday. Four of these sessions were concerned entirely with the reading of papers. The session on Friday morning was devoted partly to papers and partly to a symposium; the session on Saturday afternoon was devoted partly to the showing of motion pictures. An outline of the program is presented below. Titles marked with an asterisk were illustrated by lantern slides.

THURSDAY MORNING SESSION

Welcome by MR. JOHN ANSON FORD, Chairman, Board of Supervisors, County of Los Angeles.

Response on behalf of the American Ornithologists' Union.

Report on the Business Meetings; announcements on the results of elections and the Brewster Memorial Award.

Announcements from the Local Committee on Arrangements.

The Problem of Cerophagy in the Honey-guides. HERBERT FRIEDMANN, U.S. National Museum, Washington.

*The Demonstration of Species Formation in Birds. ALDEN H. MILLER, Museum of Vertebrate Zoology, University of California, Berkeley.

*Acoustic Orientation in the Oil-bird, *Steatornis caripensis*. DONALD R. GRIFFIN, Biological Laboratories, Harvard University, Cambridge.

*Mating Behavior of the Brewer's Blackbird. THOMAS R. HOWELL and RICHARD JOHNSON, Department of Zoology, University of California, Los Angeles.

*Color Specification for Biologists. E. M. REILLY, JR., and RALPH S. PALMER, New York State Museum, Albany.

THURSDAY AFTERNOON SESSION

*Social and Nesting Habits of Pentland's Tinamou. CARL KOFORD, Museum of Vertebrate Zoology, University of California, Berkeley.

Feigning in North American Parulidae. FREDERICK V. HEBARD, Philadelphia.

*Studies on Habitat Preference in the Birds of Jackson Hole, Wyoming. GEORGE W. SALT, Department of Zoology, University of California, Davis.

A Blancan Avifauna from Kansas. HARRISON B. TORDOFF, Museum of Natural History, University of Kansas, Lawrence.

Remarks on Bill Proportions of Birds. DEAN AMADON, American Museum of Natural History, New York.

*Some Evidence for Genetic Change in a Hybrid Titmouse Population. KEITH L. DIXON, Agricultural and Mechanical College of Texas, College Station.

Productivity Records of the Mourning Dove in California. JOHN B. COWAN, Gray Lodge State Refuge, Gridley, California.

*Status of the Hudson River Eyries. RICHARD A. HERBERT and KATHLEEN GREEN SKELTON, New York.

*Population Responses of the Brown Towhee to Foothill Vegetation. HENRY E. CHILDS, JR., University of California, San Joaquin Experimental Range. O'Neals.

*Nesting of the White Pelican and Other Colonial Waterbirds at Anaho Island, Nevada. DAVID B. MARSHALL, U. S. Fish and Wildlife Service, Fallon, Nevada.

*Migration of the White Pelicans of Gunnison Island, Great Salt Lake. WILLIAM H. BEHLE, University of Utah, Salt Lake City.

FRIDAY MORNING SESSION

*Annual Gonad and Thyroid Cycles of the English Sparrow in Southern California. JOHN DAVIS, Hastings Reservation, Monterey County, California.

*Production of Repeated Gonadal, Fat, and Molt Cycles within One Year in the Junco and White-crowned Sparrow by Manipulation of Photoperiod. ALBERT WOLFSON, Department of Biological Sciences, Northwestern University, Evanston, Illinois.

SYMPOSIUM ON AVIAN METABOLISM
Moderator: OLIVER P. PEARSON

Metabolism of Flight. GEORGE W. SALT, Department of Zoology, University of California, Davis.

*Water Metabolism of Birds. WILLIAM R. DAWSON, Department of Zoology, University of Michigan, Ann Arbor.

*Metabolic Economy of Arctic Birds. LAURENCE IRVING, Arctic Health Research Center, Public Health Service, Anchorage, Alaska.

*Bio-energetics of Some California Birds. OLIVER P. PEARSON, Museum of Vertebrate Zoology, University of California, Berkeley.

SATURDAY MORNING SESSION

Vagrancy of Central California Cliff Swallows. WILBUR W. MAYHEW, Atomic Energy Project, University of California, Los Angeles.

*Interspecific Relations of Breeding Gulls. DAVID W. JOHNSTON, Museum of Vertebrate Zoology, University of California, Berkeley.

*Variation and Evolution in *Zonotrichia leucophrys*. BARBARA BLANCHARD OAKESON, University of California, Santa Barbara College.

*Avian Predators in the Lemming Cycle at Barrow, Alaska. FRANK A. PITELKA, Museum of Vertebrate Zoology, University of California, Berkeley.

*Species Limits in the Red-eyed Towhees. CHARLES G. SIBLEY, Department of Conservation, Cornell University, Ithaca, New York.

*Outstanding Features of the Ralph Ellis Library of Ornithology at the University of Kansas. ROBERT M. MENGEL, University Library, and Museum of Natural History, University of Kansas, Lawrence.

Montane Birds of Northeastern Sonora. JOE T. MARSHALL, JR., University of Arizona, Tucson.

*Patterns of Bird Distribution and Migration in Arizona and Northern Sonora, Past and Present. ALLAN R. PHILLIPS, Museum of Northern Arizona, Flagstaff.

*The Influence of Density of Chaparral Vegetation on Territory Size in the Bewick's Wren and the Spotted Towhee. HOWARD L. COGSWELL, Mills College, Oakland, California.

*Variation in the Rough-legged Hawks of North America. TOM J. CADE, Department of Zoology, University of California, Los Angeles.

*Comments on the Biogeography of Arabia, with Special Reference to the Avifauna. S. DILLON RIPLEY, Peabody Museum of Natural History, Yale University, New Haven, Connecticut.

SATURDAY AFTERNOON SESSION

Recorded Songs of Some Western Birds. WILLIAM R. FISH, China Lake, California.

*The Havasu Lake National Wildlife Refuge. GALE MONSON, Havasu Lake National Wildlife Refuge, Parker, Arizona.

On the Nesting of Bent's Crossbills (motion picture). ALFRED M. BAILEY, Denver Museum of Natural History, Denver, Colorado.

Indefatigable Island (motion picture). ROBERT I. BOWMAN, Museum of Vertebrate Zoology, University of California, Berkeley.

Hummingbirds in the Chiricahua Mountains (motion picture). BERT HARWELL, Berkeley, California.

*Development of the Stillwater Wildlife Management Area, Nevada. DAVID B. MARSHALL, U. S. Fish and Wildlife Service, Fallon, Nevada.

OTHER EVENTS

On Wednesday evening a dinner for the Fellows was given by the Local Committee in the Regency Room of the Ambassador Hotel. Forty-one persons attended. Following the dinner, Dr. and Mrs. Van Tyne entertained over 250 members and guests of the Union at an after-dinner coffee hour on the Lido Terrace at the Ambassador Hotel.

A reception and open house were held at the Los Angeles County Museum on Thursday evening; 211 members and guests were present. Hosts for the evening were Jean Delacour, Director, and members of the Museum's Board of Governors. Persons attending this reception had an opportunity to examine the Museum's galleries and collections.

A special exhibition of bird art entitled "Portraits of Birds" consisted of original paintings of Mexican birds by the late Andrew Jackson Grayson and paintings of North American birds by two young bird artists, Mr. Robert Verity Clem, of Hamden, Massachusetts, and Mr. William D. Berry, of Los Angeles, California. Supplementing the bird paintings were forty beautiful large carbro prints of western birds photographed by Mr. Don Bleitz of Los Angeles.

Following the precedent set by the 1952 meeting at Baton Rouge, the paper sessions were interrupted on Friday afternoon. A.O.U. members and guests visited the famous Huntington Library and Art

Galleries and attended an open house at the Robert T. Moore Ornithological Laboratory on the campus of Occidental College. Eighty-five members and guests participated in this outing.

On Saturday evening, 170 members and guests attended the Annual Banquet in the Gold Room of the Ambassador Hotel. Entertainment was provided by the guest of honor, Mr. Red Skelton of motion picture and television fame. Additional entertainment of an ornithological nature was provided by a remarkably well-trained talking African Gray Parrot.

The field trip on Sunday took sixty members and guests by chartered buses to a variety of bird habitats. The trip of 160 miles included visits to coastal shore bird localities as well as stopovers in oak woodland and high mountain pine forests. A number of interesting species were observed throughout the day in these varied areas.

Special features for the wives of visiting ornithologists included visits to the Will Rogers ranch and the Farmers' Market, an afternoon as guests of the Walt Disney Studios, and a trip to the early California Mission at San Gabriel and a nearby Mexican shopping area.

RESOLUTIONS

WHEREAS, The American Ornithologists' Union is about to conclude its Seventy-first Stated Meeting, the first to be held in the great city of Los Angeles; therefore be it

Resolved, That we express the deep gratitude of the Union to the Local Committee on Arrangements, which has served so efficiently and untiringly under the able leadership of Jean Delacour and Kenneth E. Stager, with the aid of Vernon Barrett, J. C. von Bloeker, Jr., John Davis, Walt Disney, C. V. Duff, Wade Fox, Jr., Ed N. Harrison, Hildegarde Howard, Thomas R. Howell, Earle R. Greene, Rufus B. von Kleinsmid, Robert T. Moore, J. R. Pemberton, Sidney B. Peyton, Howard Robertson, W. J. Sheffler, and Ray Thomas; and be it further

Resolved, That we express the full appreciation of the American Ornithologists' Union to the University of Southern California for the use of its magnificent facilities and to the Board of Governors of the Los Angeles County Museum for its delightful reception and art exhibit provided for our pleasure.

Be It Finally Resolved, That we express the thanks of the American Ornithologists' Union to the trustees of the Huntington Gardens and Library, and to Robert T. Moore and Occidental College, for their hospitality.

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COMMITTEE ON THE NOMINATION OF HONORARY AND CORRESPONDING FELLOWS. Josselyn Van Tyne, *Chairman*. Jean Delacour, Ernst Mayr.

COMMITTEE ON THE NOMINATION OF ASSOCIATES. Douglas S. Miller, *Chairman*. (Membership to be announced later.)

COMMITTEE ON CLASSIFICATION AND NOMENCLATURE OF NORTH AMERICAN BIRDS, Alexander Wetmore, *Chairman*. Herbert Friedmann, *Vice-chairman*, Dean Amadon, Frederick C. Lincoln, George H. Lowery, Jr., Alden H. Miller, Frank A. Pitelka. Josselyn Van Tyne, John T. Zimmer.

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COMMITTEE ON VOCATIONAL INFORMATION. Gustav A. Swanson, *Chairman*. Maurice Brooks, Ira N. Gabrielson, George H. Lowery, Jr., Harrison B. Tordoff, Albert Wolfson.

LOCAL COMMITTEE ON ARRANGEMENTS FOR THE SEVENTY-SECOND STATED MEETING. A. W. Schorger, *Chairman*. John T. Emlen, G. W. Foster, James B. Hall, Joseph J. Hickey, W. E. Lanyon, James Larson, Robert A. McCabe, Mrs. A. W. Schorger, Walter E. Scott, Mrs. Walter E. Scott.

GENERAL NOTES

The Wintering Meadowlarks of Dane County, Wisconsin.—The 1931 edition of the A.O.U. Check-List states that the Western Meadowlark (*Sturnella neglecta*) winters casually east to southern Wisconsin. Actually this species is a regular winter resident in considerable numbers, especially in Green County most of which was originally prairie. On the basis of sight identification, the western bird appeared to be the prevailing winter resident. My main interest was the winter status of the Western Meadowlark in comparison with the Eastern Meadowlark (*Sturnella magna*). In order to obtain positive data, I collected 8 Meadowlarks between December 29 and February 26 during the four winters, 1949–50 through 1952–53. Seven of the specimens were of the western bird and one the eastern. All were males. The sample is too small to generalize on the sex ratio and the relative abundance of the two species. It appears, however, from the specimens and sight identifications that the Eastern Meadowlark constitutes less than 10 per cent of the wintering population.

Sight identification of the two species can only be positive within narrow limits. When the ground is completely covered with snow, Meadowlarks are forced to feed where manure has been piled or scattered in the fields and especially along the roads where the snow-plows lay bare the shoulders. The birds become so accustomed to traffic that it is usually easy, by slow driving, to pass within 10 to 20 feet of the feeding birds. The species can then be determined by the color of the back. At a distance the backs of both species appear dark, and the observer is inclined to assign the birds to the more darkly colored eastern species. Under the distance limitations imposed, all of the specimens taken were correctly identified prior to collecting.

The stomachs of the collected specimens showed that they were living very largely on corn and oats. The stomach of the Eastern Meadowlark, collected February 21, 1952, was filled with corn. It was very fat and weighed 121.2 grams. Molt was in progress on the breast. The Western Meadowlarks weighed from 93.3 to 119.8 grams, the average being 108.0 grams. Fat when present was confined largely to the neck area. The stomach contents of a specimen taken December 30, 1951, were mainly oats but a few insects were present. Professor Edwin W. King identified the insect fragments as representing: 6 curculionids, subfamily Otiorhynchinae; 1 hemipteran; and a lepidopterous larva.

I have no positive information that the two species associate at any time. On December 30, 1951, I saw a Western Meadowlark feeding with a mixed flock of Starlings, Red-wings, and Cowbirds.

No accurate data on the wintering populations and their losses could be obtained. On November 29, 1950, a flock of 32 Meadowlarks was found at Pine Bluff, 20 of which were sufficiently close to be identifiable as the western species. This flock disappeared and could not be found during the remainder of the winter. The winter of 1950–51 was marked by deep snow and some low temperatures. On January 17, 1951, I drove from Madison southward through Monroe to the Illinois state line, a distance of 52 miles. I counted 21 Meadowlarks in Dane County and 13 in Green County. The night of January 30 the temperature dropped to 37° below zero at Truax Field, Madison. The above route was covered again on February 21 and only one Meadowlark was seen. It would be a mistake to assume that nearly all of these birds had perished. In spite of the limitations on feeding grounds imposed by the snow and the marked tendency of small flocks to adhere to a limited area, it was impossible to locate the birds at will. I have made a round trip of twenty miles over a stretch of road during a forenoon without seeing a Meadowlark though I knew the exact places along the road that were used. A trip in the afternoon of the same day might reveal all or a part of the number wintering.

In winter of 1950–51, I selected a circuit, 44 miles in length, that was covered repeatedly. The maximum count of 16 Meadowlarks was obtained December 31, 1950. This number dwindled to two birds seen on February 22, and again on February 23. This represents a potential loss of 88 per cent. I doubt if the true loss was this high. What causes an initially high or low wintering population is uncertain. Field observations indicate that a November snowstorm will hold most of the Meadowlarks present at the time. The pleasant, prolonged fall of 1952 was followed by an exceptionally mild winter; however, during the entire winter I was unable to find in the county more than four Western Meadowlarks, all in one flock.—A. W. Schorger, *168 N. Prospect Ave., Madison, Wisconsin.*

The Ipswich Sparrow (*Passerculus princeps*) on Chesapeake Bay, Virginia.—The presence of the Ipswich Sparrow in winter on the coast of Virginia has long been known, but because of its highly selective habitat its exact status has never been accurately determined. For example, Rives termed it "common in winter at Cobb's Island" (A Catalogue of the Birds of the Virginias, 1890: 73); and according to Grey, from Cape Henry south to the North Carolina line there are only four definite records (Raven, 21: 93, 1950). Murray summarizes the few records available and states that it is a "scarce winter visitor on the coast" (A Check-list of the Birds of Virginia, 1952: 107). Therefore it comes as a surprise to discover that it is apparently a regular but highly local transient and winter visitor on certain parts of the western shore of Chesapeake Bay.

Away from the immediate coast the Ipswich Sparrow was first seen in Virginia at Seaford, York County, on November 25, 1949, by Dr. John H. Grey, Jr., Charles E. Stevens, and the writer. Because of the unusual nature of this record the writer returned on December 2 and collected what was presumably the same bird. This specimen is now in the collection of the U. S. National Museum. Since that first record, individual birds have been recorded once or more each winter by several observers, including, in addition to the above named, R. J. Beasley and R. A. Glassel. All records thus far have been on the immediate Bay shore between Hampton Roads (lower James River) and York River, locally known as the Lower Peninsula. Generally, only one or two birds are recorded on any one trip, but on January 23, 1953, Grey and the writer found three together at Grandview, Hampton (formerly Elizabeth City) County. Returning to this area on January 30, the same observers made a careful census along three miles of Bay shore from Grandview north to Northend Point. At least seven Ipswich Sparrows were seen on this census, of which two were collected, far more than have been reported on any single day even on the coast of Virginia.

The almost exclusive habitat of this species on the coast is the grass-covered sand dunes and the beaches of the outer barrier islands. On the western shore of southern Chesapeake Bay the habitat is similar in character but far different in scope. The dunes here, in the few places they occur, range from about 20 to 100 feet (rarely 300 feet) in depth, separating the narrow Bay beach from extensive salt marshes. It is rare to find a dune here rising over 10 feet above the beach. The Ipswich Sparrows usually prefer the grassy stretches of the dunes, although they frequently visit the tidal debris on the beach to feed, often in company with Savannah Sparrows (*Passerculus sandwichensis*). Occasionally, when flushed from the dune grass, they will fly into the bushy edges of the salt marshes.

The sudden abundance of records for this species on Chesapeake Bay should not be construed to mean that it has recently extended its range. Rather, this probably indicates merely an increase of field work where little has been done previously.—Frederic R. Scott, *27 Malvern Avenue, Richmond 21, Virginia.*

A Juba River Race of Klaas's Cuckoo.—Until G. L. Bates (1937, Bull. Brit. Orn. Club, 57: 150) described *Chrysococcyx klaasi arabicus* from Asir, Arabia, it was generally agreed that Klaas's Cuckoo could not be divided into geographic races. Some variation in size was evident, but this was not at all clear-cut. The coloration in general is the same from the Gambia to South Africa (the type locality).

Some time ago Dr. V. G. L. van Someren lent me two adult males and two females from the Juba River, which in his opinion differed noticeably from most other birds collected in eastern Africa. Comparison of these specimens with extended series of *C. klaasi* in the American Museum of Natural History, and the British Museum too, has convinced me that these four birds from Somalia (two females and a male from Serenli, one male from Hillesheid) do differ sufficiently to be distinguished trinomially, and I propose for them the name.

Chrysococcyx klaasi somereni, new subspecies

Type: A.M.N.H. No. 704,637, adult male, Hillesheid, Juba River, southern Somalia, July 1922. Wing 96, tail 72, culmen from base 18.5 mm.

Diagnosis: In the males, the most conspicuous character is the white outer edging of the greater and middle wing coverts, the secondaries, and the primaries as well. The glossy green patches extending down the sides of the fore-neck to the chest are reduced in extent, and the green stripe down the outside of the tibial feathering also seems narrow. The pattern of the outer rectrices is about the same as in *C. k. klaasi*, not dark on the outer webs as stated for *C. k. arabicus* by Bates.

The females of *somereni* are lighter in general coloration than those of nominate *klaasi*, the barring of chest and flanks is decidedly narrow and the darker patches that usually extend down to the sides of the chest are faint, washed out, and entirely broken up by buff or whitish barring. On the upper surface of the wings the usual brown barring shows a tendency to become whitish at the outer edges of the feathers. The outer retrices of these two females have much the same pattern as those of females from Abyssinia.

Remarks: The wing of the male from Serenli measures 97; the tail, 67; the culmen to base, 17 mm. The two females from Serenli have wings 97 and 99 mm., tails 69 and 70, and culmen from base 18 in both.

It should be pointed out that white edgings on the upper surface of the wings are very occasionally present in males from Southern Rhodesia and the Transvaal.

The wings are longer (100 to 106 mm.) in South African males. Two males from Roka and the Northern Guaso Nyiro in Kenya Colony show scarcely any approach in color to *C. k. somereni*, but are short-winged (91 and 94 mm.). Not much emphasis can be placed on size, however, for West African birds average slightly smaller than those of South Africa.

Skins from Ethiopia and British Somaliland are typical *klaasi*, so the range of *somereni* seems to be restricted to the Juba River region of Somalia and perhaps the immediately adjacent portions of Kenya Colony.—James P. Chapin, *c/o IRSAC, Boite Postale 217, Bukavu, Kivu, Belgian Congo.*

House Martin and Swift from Ascension Island. In February 1947, I received a skin of the House Martin (*Delichon urbica*) from Mr. G. Addison-Williamson. He had secured the bird by hand as it perched, completely exhausted, on a piece of machinery on the dock at Georgetown, Ascension Island. This was on November 2, 1946. A ship had arrived that morning from England, but it is doubtful whether a swallow would find it advantageous to stay with a ship for any length of time. The specimen is now number 343,884 in the collection of the American Museum of

Natural History. Three days later on November 5, and again on November 7, Mr. Addison-Williamson saw a swallow, apparently of the same species, flying around the pier on Ascension Island. He also remarks that he often observed some species of swift, black in color, flying around Ft. Thornton. This reminded me that in October, 1942, I had seen a swift, evidently of the genus *Apus*, flying over the harbor at Ascension. No swifts or swallows are resident on Ascension and the above records seem to be the first for these families from that island.—JAMES P. CHAPIN, *c/o* IRSAC, *Boite Postale 217, Bukavu, Kivu, Belgian Congo.*

Breeding Dates for Barn Owls in Southern California.—In Paul A. Stewart's excellent paper, "Dispersal, Breeding Behavior, and Longevity of Banded Barn Owls in North America," (Auk, 69: 227–245, 1952), I was astonished to note (page 244) that "Barn Owls in southern California breed only during March, April, May, and June, with the peak occurring in April."

Having observed Barn Owls here for over half a century, I looked up my notes and found records of 32 sets of eggs taken in Los Angeles and San Bernardino counties of southern California. I have one record for January (eight slightly incubated eggs taken January 17, 1926), 10 records for February, 16 for March, and 6 for April; the latest being 3 fresh eggs on April 16, 1918. The mean date for all sets is March 10.

The mean weight of 76 eggs was 23.28 grams. Both the largest and the smallest eggs were in sets of six eggs, each from Colton, San Bernardino County, the incubation being slight to advanced in both sets, which I was able to blow with small holes. The weights in grams of the eggs in these sets were: March 12, 1925, 27.17, 26.89, 26.63, 26.43, 26.24, and 25.94; March 5, 1927, 22.06, 21.89, 21.61, 20.81, 19.33, and 19.11.—WILSON C. HANNA, *712 North Eight Street, Colton, California.*

Mute Swan (*Cygnus olor*) observed diving.—In their article "The Family Anatidae" (Wilson Bulletin, 1945), Delacour and Mayr state (page 9) "All swans, except the Mute Swan, have been observed diving, although rarely." At the Kellogg Bird Sanctuary a flock of pinioned swans is allowed the freedom of a thirty-acre lake. This flock consists of about 20 Whooper (*Cygnus cygnus*), 12 Mute, and 2 to 4 Black Swans (*Cygnus atratus*). Since coming to the Sanctuary in June, 1948, I have noted with particular interest the diving activities of the swans. Whooper Swans have often been observed to swim underwater when attempting to escape another swan. Generally they swim 15 to 20 feet underwater, but on occasion I have noted one travel 50 to 60 feet.

On July 21, 1953, I watched a pair of Mute Swans with their two half-grown cygnets (about 9 weeks old) splashing about in the water and chasing one another. Suddenly one of the cygnets dove and swam eight to ten feet under water. It surfaced alongside of the second cygnet and immediately both young dove and swam about fifteen feet underwater. The cygnets surfaced, looked about then promptly dove again, traveling about ten feet under water. The four birds then settled down and busied themselves by preening.

I have not observed a Mute Swan dive and swim underwater when attempting to escape another swan as in the case of the Whooper Swans. Both adult and young Whooper Swans have been seen diving in a manner similar to that recorded here for the Mute Swan. I have not seen any of our Black Swans dive.—A. E. STAEBLER, *Director, W. K. Kellogg Bird Sanctuary of Michigan State College, Hickory Corners, Michigan.*

RECENT LITERATURE

The California Condor.—CARL B. KOFORD. Natl. Audubon Soc. Research Report No. 4, xiii + 154 pp., 1 col. photo., 31 pls., 15 text-figs., May 20, 1953. $3.00.—This book represents the fourth in a series of studies, on "threatened" species of birds, sponsored by the National Audubon Society. The work on the condor was completed through the joint efforts of the Society and the Museum of Vertebrate Zoology of the University of California. Such cooperation has produced an excellent fulfillment of the primary objective, which was to obtain all possible data on the natural history of the California Condor and to interpret these for the best procedure in conserving the species.

Carl Koford practically lived with the condor from 1939 to 1941, and he did additional field work after World War II. However, he has not relied solely on personal observations; he made an extensive search of the literature and interviewed many persons whose regular or intermittent interests had brought them into contact with these birds.

The summary of records of occurrence (fossil, historical, and Recent) indicates a more or less continuous constriction of the range. The primary factors seem to have been the food supply and the activities of man. Yearly variations in range are largely the result of the presence or absence of suitable food in the proper location. There is a latitudinal movement correlated with the seasonal distribution of food. In the fall the birds tend to move southward to winter roosting areas; in spring the movement is northward in the mountains on either side of the San Joaquin Valley. The estimated total population is about sixty birds; it is thought to be a fairly stable number, consisting each year of perhaps ten adults at five successful nests, thirty non-nesting adults, and twenty immature birds up to five or six years of age.

Although many factors have been operating to the detriment of the species, two seem especially important—food and the activities of man. Suitable food (*i. e.* suitable kind in proper place at right time) may have been largely responsible in determining distribution and numbers. In Pleistocene times the large carnivores and ungulates provided ample food. As these disappeared the birds were forced to feed on dead sea animals and on smaller terrestrial forms. By 1820 large herds of domestic animals were present in the condor's range. Care of these sheep and cattle was not as meticulous as it is today, and the dead animals on the range constituted a major source of food. As the railroads were built it became more profitable to till the land, and the herds decreased in size. Further, the animals were more valuable and received better care. The food supply was thus reduced, but probably not disastrously.

Koford's detailed observations on feeding habits are of interest. Some of these are: weight and soaring adaptations fit them for long range scouting and feeding on large carcasses in open country; beef cattle, particularly calves, are at present the chief food item; equine carcasses are "comparatively unattractive"; condors are not known to feed on dead birds; each bird may eat two or three pounds per day; but it also has the ability to go without food for several days; and there are no records of condors killing animals for food. The "preference" for calves over adult cattle, and for cattle over horses, may come about because of the toughness of the hide.

There is much detailed information on nesting sites and eggs and on the behavior of the adults at the nest. Condors first mate at about five or six years of age. On the basis of fifteen nest-sites, the author determined some of the primary physical requisites of the site—cavity in cliff (or giant tree, in one instance) large enough for two adults; suitable roosts and perches nearby; easy approach from the air; flat, soft floor for egg and chick; and protection from storms, winds, and direct sunshine.

No territorial defense was noted, although previously it had been reported by Finley. Koford has suggested that several things may be responsible for the lack of this particular behavior pattern in the condor. The nests are usually far apart; the shortest distance between any two nests was one-half mile. The sites tend to be used over a period of years, but not necessarily for successive nestings and rarely in successive years. The birds probably attain a considerable age—some forty to fifty years, at least in captivity. Therefore, the birds over the years may learn to avoid the nest-sites of others. This concept is strengthened by the author's observation that nesting adults may at times chase immature birds. These latter, it might be presumed, were too young to know better.

The nesting adults are keenly aware of human disturbances within five hundred yards of the nest. On page 109 the author notes "One man can keep a pair of condors from the egg all night or prevent the feeding of a chick for an entire day merely by exposing himself within five hundred yards of a nest for a few minutes at one or two critical times of the day. Loud noises can alarm condors at distances of over one mile."

It is not possible here even to mention all the areas of information collected by Koford. However, there are extensive sections on behavior of condors of all ages, on flight and locomotion on the ground, some on molts and plumages, on animals associated in any way with condors, and a great deal on conservation. An appendix includes tables of weights and measurements, of attentive periods, and of growth and development of the young.

In the preface, Alden H. Miller decries the defeatist attitude of those who think the California Condor is doomed. And it is certainly true, as both Koford and Miller emphasize, that the species will disappear if we do not make efforts to save it. Most of the mortality factors discussed hinge on the activities of man. Wanton shooting still eliminates perhaps a bird a year. Collecting has accounted for about 200; there are perhaps 85 eggs, now in collections, that were removed from the nests between 1896 and 1909. Within recent years permits have been issued for the capture of individuals. Some birds are accidentally caught and injured in traps set for mammals such as coyotes. Accidents such as flying into poles and wires have caused the loss of some, and the activities of sympathetic but over-eager photographers have probably resulted in some losses at nests.

Much has already been done to help the condor. The Sespe Wildlife Preserve includes most of the known nesting grounds and the primary winter roosts which are especially important since nesting starts in February. Public Land Order 695 provides for absolute protection of 16 square miles where the greatest concentration of nesting birds exists; the other 39 square miles are open to development of oil and gas leases, except that no surface activity is permitted within a half-mile of a condor nest ". . . active within three years."

An educational program must accompany conservation measures because the birds rarely remain within the confines of the Preserve. Most feeding, for example, occurs outside the protected area. The main roost areas (those used by ten or more condors, but not necessarily constantly used) are about 45 miles apart. While flocks of thirty to forty birds may yet be observed at times, conservation must start at the level of the individual. As Koford envisions the dynamics of the population, the survival of a single condor or the success of a single nest may mean a significant difference between an increase or a decrease in that year's population. There are annually perhaps only five successful nests (young survives to one year of age and independence of parents for food). However, a loss of one or even two annual

increments may not be completely disastrous; the birds have a long potential life and can thus breed in following years. This fact may be a major factor in the maintenance of the present population, in the face of many adverse conditions.

Close observation of the natural history of the condor has revealed a number of attributes which are pertinent to any conservation program. Only a few sites are used by the birds for drinking and bathing; these must be preserved, for condors are especially wary when performing these activities. Unobstructed spaces are needed for landing and taking-off; air currents, most prominent in mountainous areas, are necessary for successful soaring at which condors are particularly adept. Because a great deal of time is spent on perches and roosts, such should be present. The bird is heavy and requires a solid, steady perch with good footing. The roosting perch must be easily accessible from the air, must be high above ground, and must be protected from strong winds. The birds are easily disturbed when on the roost, which thus must be protected from disturbance. As indicated previously, a good supply of suitable food is imperative, but provision of such food by man seems impractical. The nest-site has already been characterized. In those years in which a bird breeds, it needs protection throughout the year. Courtship and nest selection consume two or three months, and incubation is at least 42 days. Fledging takes up five months, and the juvenile is completely dependent upon the adult during its first two months outside the nest cavity.

At present a "condor patrolman" is furnished jointly by the National Audubon Society and the U. S. Forest Service, but only for eight months of the year. What is most needed is a permanent man qualified to keep track of the condor population and environmental trends and to educate persons with whom condors come in contact. Dynamic education and cooperation of people in the condor range are essential.—HARVEY I. FISHER.

The Birds of West and Equatorial Africa.—DAVID A. BANNERMAN. Edinburgh: Oliver and Boyd. 2 vols., 1526 pp., 54 pls. (30 in color), 433 figs. in text. Price: 6 pounds, 6 shillings, net. This copiously illustrated work in two stout volumes is described on the publisher's dust jacket as a concise guide to the birds of the vast area it covers. It is, however, more than that as it includes condensed but generally complete accounts of the habits—habitat, vocalisms, nests, eggs, and other aspects of the life history where called for—as well as statements of range and keys for ready identification. Furthermore, in all species inhabiting West Africa that are represented in the Belgian Congo, Kenya Colony, Uganda, and the Sudan by other races, these eastern subspecies are mentioned in the text as well, and their distribution given. Of the 1536 species and subspecies of birds found in West Africa, approximately three-fourths range across the continent, so it is apparent that this book includes many birds of interest to students in central and eastern Africa.

On the whole the present book is based on Bannerman's earlier 8 volume monograph, "The Birds of Tropical West Africa," from which work the keys have been taken with only such changes as were necessitated by the inclusion of an additional bird where needed. The body of the text, however, has been rewritten completely, although, quite naturally, one finds much similarity throughout. Omitted from the present work are all descriptions of plumages, as these are considered as rendered dispensable by the presence of the keys and by the abundance of illustrations. The illustrations are similarly largely drawn from the earlier and larger work, but six of the colored plates are new. The reduction in size of the plates from the earlier work has been done with remarkably little loss in effect; a few of the new, reduced versions

are slightly darker than their larger predecessors, such as the plate (actually two plates on one page) of the sunbirds, and that of the bare-headed rock-fowl (*Picathartes gymnocephalus*) where the gray of the back comes out almost black, the gray seeming like little other than highlights simulating glossiness. One unfortunate transposition of names occurs on plate 8 where two pictures occur on the same page, and Latham's francolin is labeled scaly francolin, and the scaly francolin is called Latham's. I understand that this error was caught by the author when it was too late to correct it. Purchasers of the book are advised to indicate the proper allocation of the names in their copies.

No important changes in classification are proposed in this work, but in some cases where the treatment in the earlier work has been found to be wrong the correction is made and the resulting difference in treatment explained. This makes the present book easier for the man in Africa to use in connection with the large 8 volumes of its predecessor. To take a specific example, on page 741 in the discussion of the spotted honey-guide (*Indicator maculatus*), Bannerman writes, ". . . In my larger volumes I treated *Indicator maculatus* and *Indicator feae* as two distinct species. In this it seems I was mistaken, for the recent researches of Chapin and Stresemann point to the bird which I described and figured as *I. m. maculatus* being the young of *I. feae*. The former name has precedence. In the same way *Indicator theresae* Alexander becomes a synonym of *Indicator maculatus stictithorax* Reichenow . . ." It does seem strange, however, that *Passer* and its immediate relatives are still placed in the Fringillidae and not in the Ploceidae. Bannerman has been consistent in this regard, but it is one in which the change might have been suggested at least. Similarly *Neolestes torquatus* is retained in the Laniidae as in the earlier work, although the author admits that, ". . . there are strong reasons for removing it to the Pycnonotidae . . ."

Bannerman's larger, earlier work took many years for complete publication, and so much had been discovered in the meantime about West African birds that he felt obliged to add a final volume bringing the earlier ones up to date. In the present work he has inserted material subsequent to the ultimate volume of his earlier work, as, for example, in his account of Cameroon bare-headed rock-fowl (p. 1250) and in the inclusion of the recently discovered Kupé Mountain bush-shrike (p. 1195). The constant stream of accretions to our knowledge of West African birds were to a good extent the result of the impetus given to ornithology in that part of the world by Bannerman's successive volumes. The present work, cheaper to purchase and easier to carry about, should prove a stimulus over a wider area and to a greater audience.

It is probably inevitable that a book, written in a museum by an author most of whose acquaintance with West African birds is derived from museum specimens, should be weakest in such matters as stressing diagnostic field recognition marks. In a handbook dealing with better known and more populous areas this weakness would be a serious defect, but it is still true that the average bird observer in western tropical Africa collects a good per cent of the species he encounters, and the present work does enable him to identify his specimens. In this respect Bannerman's book resembles its counterpart for East Africa, the similarly two-volumed work by Mackworth-Praed and Grant. The two works together span the continent, at least in its equatorial belt.

While the present work is designed as a handbook, and as a synopsis of the earlier 8 volume work, it seems to the reviewer that a brief introductory chapter on the ecology of West Africa and its subdivisions into faunal areas might well have been

included. This would have added but a few pages, and would have been useful to readers unable to consult the larger work. Even more desirable, and less space consuming, would have been a map of West and Equatorial Africa; such an addition could even have been placed on the inside of one of the covers. But it is always easy to wish for more; we should be grateful to the author for what gives every promise of being a very useful and dependable guide to one of the most diversified and interesting avifaunas in the world.—HERBERT FRIEDMANN.

Pheasant Breeding and Care.—Jean Delacour. Fond du Lac, Wisconsin: All-Pets Books. xiv + 98 pp. Price, $3.00.—Bibliographically, this book is confusing to say the least. On the title page, Jean Delacour is listed as the author; and on page iv, we read "First Edition September 1953." The preface refers to the work as a second edition of Charles F. Denley's "Ornamental Pheasants, Their Breeding and Care." On pages xi and xii, is an introduction to the first edition written by Denley in 1935, and this is followed by an introduction to the second edition by "The Editors" who are not otherwise identified.

Denley's work has been revised by Delacour, who is well known both as an aviculturist of long experience and as an authority on the pheasants of the world, and he was assisted by Prof. Erwin L. Jungherr, who contributed the chapter on the diseases of pheasants, and by W. F. Gimmer, who helped prepare the sections dealing with game pheasants and their propagation. This book is authoritative and should prove of great value to anyone interested in keeping pheasants.—ROBERT W. STORER.

Care and Breeding of Budgies (Shell Parrakeets).—Cyril H. Rogers. New York: Dover Publications. 93 pp., 25 pls. Price, $1.75, clothbound; $0.65, paperbound.—This handbook was written primarily to assist "the many newcomers to the delightful hobby of breeding and keeping Budgerigars," and it contains information of a practical nature on a variety of subjects ranging from cages and food to ailments and the exhibiting of show birds. A particularly interesting chapter presents for the layman the results of the extensive work which has been done on the genetics of this popular cage bird.—ROBERT W. STORER.

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BAHRMANN, UDO. 1952. Ein Beitrag zur Biologie der Elster [*Pica pica pica* (L.)]. Bonner Zool. Beitr., 3: 289–304.—On the biology of the Magpie.

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BAILEY, ROBERT E. 1953. Accessory reproductive organs of male fringillid birds: seasonal variations and response to various sex hormones. Anat. Rec., 115: 1–19, 3 pls.

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BAKER, ROLLIN H., and ALBERT A. ALCORN. 1953. Shrews from Michoacan, Mexico, found in Barn Owl pellets. Journ. Mammalogy, 34: 116.

BALL, K. E. 1952. Nesting of the ring-necked pheasant on Pelee Island, Ontario. Can. Field-Nat., **66** (3): 71–81, 3 tables, 2 figs.—Nesting studies made in 1947 and 1948 in area of high pheasant density.

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BARTH, EDVARD K. 1952. Litt forplantningsbiologi hos fjellvåken, *Buteo lagopus*, og svingninger i bestanden 1938–1952. Riistatieteellisiä Julkaisuja—Papers on Game Research, **8** (1952): 127–138, 10 figs.—Breeding biology of the Rough-legged Hawk and variations in the population in north-central Norway between 1938 and 1952. English summary.

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BLACKFORD, JOHN L. 1953. Bird records from northwestern Montana. Condor, **55**: 277–278.—*Aythya collaris* (breeding) and *Dendroica striata* (present in the breeding season).

BLACKFORD, JOHN L. 1953. Breeding haunts of the Stephens Whip-poor-will. Condor, **55**: 281–286.—Habitat, nest sites, and breeding records.

BLEAKNEY, SHERMAN. 1953. Starlings in the Ungava District, Quebec Province. Can. Field-Nat., **67** (1): 44–45.—Most northern breeding record in eastern Canada.

BOUDOINT, YVES, A. BROSSET, L. BUREAU, G. GUICHARD, and N. MAYAUD. 1953. Biologie de *Circaetus gallicus*. Alauda, **21**: 86–127, figs. 1–3.—A symposium on the life history of the species in France with a summary by Mayaud. The species arrives by the middle of March and laying starts by the first of April. The clutch consists of a single egg, incubation lasts 47 days and is carried out by both parents but the female does most of it. The young stays in the nest for 70 to 75 days. The food carried to the nest consists almost exclusively of snakes; there are also many observations on behavior.—C. Vaurie.

BOUTINOT, S. 1953. Le Pétrel-tempête à Ouessant. L'Oiseau, **23**: 145–148, figs. 1–3.—Observations on the nesting and rearing of the young in *Hydrobates pelagicus*.

BOWMAN, R. I. 1952. Chimney Swift banding at Kingston, Ontario from 1928 to 1947. Can. Field-Nat., **66** (6): 151–164, 7 tables, 4 figures.—A paper of major importance in its field, since it deals with results obtained from the banding of nearly 22,000 swifts over a nineteen-year period. Recoveries from 15 states, 2 provinces, and Peru. Tentative life expectancy table and isochronal map included.—W. W. H. Gunn.

BRODKORB, PIERCE. 1953. A Pliocene Flamingo from Florida. Nat. Hist. Misc. Chicago Acad. Sci., 124, 4 pp., 2 figs.—*Phoenicopterus floridanus* described as new from the Bone Valley Formation (Middle Pliocene) of Polk County, Florida.

BÜTTIKER, W. 1953. Ein Ansiedlungsversuch von Höhlenbrütern in Central-Afrika. Acta Tropica, vol. 10, nr. 3, p. 259–263.—In an attempt to study the utilization of nest boxes as an experimental approach to the problem of local settlement by hole-nesting birds in a "bushveldt" area south of Salisbury, Southern Rhodesia, the author put up 23 such boxes (of 3 sizes—titmouse, starling, and owl size). Not one was adopted by birds during two breeding seasons, although the birds were seen in the general vicinity, but over half were used by insects, chiefly bees and wasps the first year, and all were so occupied the second season. The inference is made that social insects may thus be an important factor in limiting the dispersal of hole-nesting birds.

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CAMPBELL, BRUCE. 1951. The work of the British Trust for Ornithology. Can. Field-Nat., **65** (5): 159–162, 1 fig.—History and development, aims and activities. The Trust has its headquarters at the Edward Grey Institute, links the activities of some 1,800 bird watchers in Britain, assisting and suggesting field projects of importance and stressing the necessity for accurate methods of observation.

CAMPBELL, MITCHELL. 1951. The Dickcissel (*Spiza americana*) on the outer North Shore of the Gulf St. Lawrence, P. Q. Can. Field-Nat., **65** (6): 210.—Three observed October, 1950, one collected September, 1951.

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CENDRON, JEAN. 1953. La mue du Manchot Adélie adulte. Alauda, **21**: 77–85.—Observations on the molt during February and March at the rookery of Port aux Phoques, Adélie Land. In marked adults, the molt lasted from 9 to 17 days with an average of 12 days. During this period the bird did not feed and lost from 27 to 44 per cent of its body weight with an average loss of 40 per cent. A slight rise in body temperature took place.—C. Vaurie.

CENDRON, JEAN. 1953. Notes sur les oiseaux de la Terre Adélie (Petrels et Skuas). L'Oiseau, **23**: 212–220, pls. 14–17 and 2 maps.—Observations on *Oceanites oceanicus*, *Pagodroma nivea*, *Daption capensis*, *Thalassoica antarctica*, *Fulmarus glacialoides*, *Macronectes giganteus*, and *Catharacta maccormicki*.

CLAY, GERVAS. 1953. Some notes on the birds of the Isoka District of the Northern Province of Northern Rhodesia. Ostrich, **24:** 76–97.

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COMBS, G. F. 1952. Algae (*Chlorella*) as a Source of Nutrients for the Chick. Science, **116** (3017): 453–454, 3 tables.

CONGDON, R. T., and MRS. CONGDON. 1952. Hudsonian Godwits found nesting again at Churchill. Can. Field-Nat., **66** (5): 143–144.

COOCH, GRAHAM. 1952. Unusual foot colouration in Pintails (*Anas acuta*) and note on European recoveries. Can. Field-Nat., **66** (4): 111.—Of 108 Pintails banded in Labrador, 1951, 4 immature birds had white or pinkish webs rather than grey. One of these, banded September 7, 1951, re-trapped September 16, was shot nine days later in England.

CRINGAN, A. T. 1953. Recent records of the Magpie in Northwestern Ontario. Can. Field-Nat., **67** (1): 43–44.

DELACOUR, JEAN. 1953. Position systématique du Diamant modeste d'Australie. L'Oiseau, **23:** 144.—The species *modesta*, formerly placed in the genus *Poephila* by the author, should be transferred to *Lonchura* as shown by habits and palatal markings of the young.

DEMSTER, EVERETT R., I. MICHAEL LERNER, and DOROTHY LOWRY. 1952. Continuous Selection for Egg Production in Poultry. Genetics, **37** (6): 693–708, 1 fig., 7 tables.

DICKINSON, J. C., JR. 1953. Report on the McCabe Collection of British Columbian birds. Bull. Mus. Comp. Zool., **109:** 123–205, pls. 1–2.—Annotated list of specimens, with taxonomic notes on many of the species.

DIDIER, ROBERT. 1953. La consolidation spontanée des fractures chez les oiseaux et la modification de l'architecture des travées osseuses. L'Oiseau, **23:** 81–87, pls. 6–9.—Spontaneous healing of fractures in several species with no apparent loss of function.

DOUGLAS, CARL D., *et al.* 1953. The Influence of X-irradiation and Atabrine Upon Feathering in the Chick. Science, **117** (3037): 274, 1 fig.

DRURY, WILLIAM H., JR. 1953. Birds of the Saint Elias quadrangle in the southwestern Yukon Territory. Can. Field-Nat., **67** (3): 103–128, 2 maps.—By-product of a botanical and archaeological reconnaissance, June–Sep., 1948, along Alaska Highway between Whitehorse and Alaska boundary. Nine major vegetational associations are described (primary and secondary plant species listed) and bird species are listed accordingly, then sub-divided into primary and secondary species. Bird species are then catalogued on the basis of geographical affinities, with particular reference to possible spread from large and small refugia postulated by Hultén. The author indicates a similarity of pattern to that found in studies of geographical botany. An annotated list covers 107 bird species observed, identification to subspecies resting on Rand's "List of Yukon Birds and those of the Canol Road (1946)."

DUNBAR, MOIRA. 1951. Nighthawk stamina. Can. Field-Nat., **65** (5): 186–187.—Wounded bird able to fly away strongly on release after 80 hours without food.

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ETCHÉCOPAR, R. D. 1953. Cinq spatules dans le Morbihan. L'Oiseau, **23:** 240—*Platalea leucorodia* in Brittany in August.

ETCHÉCOPAR, R. D., and F. HUE. Notes prises au cours d'un voyage en Tunisie. L'Oiseau, **23**: 221–239.—Species noted.

FISH, WILLIAM R. 1953. A method for the objective study of bird song and its application to the analysis of Bewick Wren song. Condor, **55**: 250–257.—Valuable discussion of equipment for recording and analyzing bird songs and an analysis of the song of *Thryomanes bewickii*, illustrating how this equipment may be used.

GABRIELSON, IRA N. 1952. Notes on the birds of the north shore of the Gulf of St. Lawrence. Can. Field-Nat., **66** (2): 44–59, 1 map, 6 photographs.—The author accompanied Dr. Harrison Lewis on his official inspection along the North Shore, June 4 to July 10, 1947. Ten waterfowl sanctuaries, numerous other islands and coastal points visited. General comments plus notes on 103 species. A useful map of North Shore.

GABRIELSON, IRA N., and FREDERICK C. LINCOLN. 1953. Status of the Lesser Common Loon. Condor, **55**: 314–315.—Recommendation that *Gavia immer elasson* be reduced to a synonym of *G. i. immer*.

GLOVER, FRED A. 1953. Summer foods of the Burrowing Owl. Condor, **55**: 275.—Five major food items in order of frequency of occurrence were: scorpions, lamellicorn beetles (Scarabidae), locusts (Locustidae), ground beetles (Carabidae), and pocket mice and kangaroo rats (Heteromyidae).

GODFREY, EDWARD F., B. B. BOHREN, and R. GEORGE JAAP. 1953. "Jittery," A Sex-linked Nervous Disorder in the Chick. Journ. Heredity, **44** (3): 108–112, 2 figs, 6 tables.

GODFREY, W. EARL. 1951. Comments on the races of the Myrtle Warbler. Can. Field-Nat., **65** (5): 166–167.—Breeding birds of the Canadian Prairie Provinces, east of the Rockies, are nearer the nominate race, *Dendroica coronata coronata* (Linnaeus), than they are to *D. c. hooveri* of Alaska, Yukon, northern B. C., and probably Mackenzie Delta.

GODFREY, W. EARL. 1951. A new northwestern Olive-backed Thrush. Can. Field-Nat., **65** (5): 172–174.—*Hylocichla ustulata almae* Oberholser (1898) must, in the author's opinion, be relegated to the synonymy of *H. u. swainsoni*. A newly described race is named *H. u. incana*, known range being southern Yukon, northern B. C., and north central Alberta.

GODFREY, W. EARL. 1952. Christmas bird census—1951. Can. Field-Nat., **66** (2): 59–66.—From 27 locations across Canada from Newfoundland to Vancouver Island. Most are additional to those appearing in *Aud. Field Notes*.

GODFREY, W. EARL. 1952. Erroneous records of *Empidonax wrightii* in Manitoba and at Belvedere, Alberta. Can. Field-Nat., **66** (3): 89.—Manitoba specimens taken by P. A. Taverner, identified at the time as the Wright Flycatcher [1927, Auk, **46** (2): 224], prove upon re-examination to be *E. minimus*.

GODFREY, W. EARL. 1953. Christmas bird census—1952. Can. Field-Nat., **67** (1): 32–39.—26 censuses from points across Canada, Newfoundland to Vancouver Island; some additional to those appearing in *Aud. Field Notes*.

GODFREY, W. EARL. 1953. Notes on Ellesmere Island birds. Can. Field-Nat., **67** (2): 89–93.—Comments on two small bird collections from Ellesmere recently received by Natl. Mus. Can., with particular reference to affinities with Greenland avifauna. Extension of breeding range into Canada of such Old World races as *Arenaria interpres interpres*, *Calidris canutus canutus* and, probably, *Acanthis hornemanni hornemanni*. Annotated list of 20 species.

GRAY, J. C., and E. W. POWELL. 1952. Maintenance of contraction of Embryonic Chick Hearts *in vitro*. Science, **116** (3009): 232–233.

GRIFFIN, DONALD R. 1953. Acoustic orientation in the Oil Bird, *Steatornis*. Proc. Nat. Acad. Sci., **39**: 884–893.—Evidence to show that Steatornis "guides its flight through dark caves by a type of acoustic orientation similar to that used by bats, but the oil bird employs for this purpose short pulses of sound that lie well within the frequency range of human hearing."

GUHL, A. M., and L. L. ORTMAN. 1953. Visual patterns in the recognition of individuals among chickens. Condor, **55**: 287–298.—Results of this experimental study indicate that recognition of individuals and memory promote the stability of the social organization. Modification of features must be abrupt and quite pronounced to cause a loss of recognition.

GUIGNET, C. J. 1952. The European Starling on Vancouver Island. Can. Field-Nat., **66** (1): 37.—Now established.

HAMMOND, JOHN, JR. 1953. Photoperiodicity in Animals: The Role of Darkness. [Comments and Communications section.] Science, **117** (3041): 389–390, 1 table.

HAMRUM, CHARLES L. 1953. Experiments on the Senses of Taste and Smell in the Bob-white Quail (Colinus virginianus virginianus). Amer. Midland Nat., **49**: 872–877.—"These experiments indicate that both the odor and taste of a food probably influence food choice of this animal."

HERBERIGS, H. 1953. Note sur le comportement de la buse (*Buteo buteo*) dans ses quartiers d'hiver. Gerfaut: **43** (2–3): 132–142.

HERMAN, C. M. 1952. Wildlife Disease Association. Science, **116** (3011): 269–270.—This organization was formed at 17th N. A. Wildlife Conference.

HERROELEN, P. 1953. Note sur le comportement du Martinet noir (*Apus apus*) au Congo Belge. Gerfaut, **43** (2–3): 161–164.—First migrants appear in the beginning of August in bands of 30 to 50 individuals, increasing later to several hundreds. The return flight starts at the end of February but some individuals do not leave until the end of May. The molt lasts from August to February. In Flemish with French résumé.—C. Vaurie.

HÖHN, E. O. 1951. Courtship behaviour of the Bohemian Waxwing. Can. Field-Nat., **65** (5): 168–169.

HÖHN, E. O. 1953. Display and mating behaviour of the Black Grouse, *Lyrurus tetrix* (L.). Brit. Journ. Animal Behaviour, **1**: 48–58.

HÖHN, E. O. and A. OEMING. 1953. Song Sparrows in central Alberta in winter. Can. Field-Nat., **67** (2): 94.

HOLDOM, MARTIN W. 1952. White-crowned Sparrow (*Zonotrichia leucophrys pugetensis*) and Bantam Hen. Can. Field-Nat., **66** (2): 68.—A Bantam Hen brooding eggs in nest of White-crowned Sparrow.

HOLLIDAY, C. S. and I. C. TAIT. 1953. Note on the nidification of *Buccanodon olivacea woodwardi* (Shelley). Ostrich, **24**: 115–117.

HOLLOM, P. A. D. 1953. Le Chevalier stagnatile en Camargue. Alauda, **21**: 135.—A record of *Tringa stagnatilis* on May 11.

HUE, FRANÇOIS. 1953. Oiseaux rencontrés au Tafilalet et au sud du Haut Atlas. Alauda, **21**: 128–131.—List of species observed in southern Morocco.

HUGHES, WM. M. 1951. Wintering of Golden-crowned Sparrows *Zonotrichia coronata* (Pallas), at Vancouver, B. C. Can. Field-Nat., **65** (5): 186.—Fifteen immature birds banded winter 1950–51.

HUGHES, WM. M. 1951. Some observations on the Rusty Song Sparrow, *Melospiza melodia morphna* Oberholser. Can. Field-Nat., **65** (5): 186.—Behavior.

HUTT, F. B. 1952. The Jansen Khaki Campbell Ducks. Journ. Heredity, **43** (6): 277–281, 4 figs., 1 table.

HUTT, F. B. and R. K. COLE. 1953. The Interaction of Genetic and Environmental Influences Affecting the Incidence of Avian Leucosis. Science, **117** (3051): 695–697, 1 fig.

HYDE, A. SIDNEY. 1953. Perceptive powers of a Duck Hawk. Condor, **55**: 277.

IRWIN, M. R. 1953. Evolutionary Patterns of Antigenic Substances of the Blood Corpuscles in Columbidae. Evolution, **7** (1): 31–50, 4 tables.

JOBIN, LEO. 1953. A record of the Hudsonian Godwit in the Cariboo District of British Columbia. Condor, **55**: 318.

JOHNSGARD, PAUL A. 1953. Waterfowl of North Dakota. (N. Dak. Inst. Regional Studies and N. Dak. Agric. College, Fargo) 16 pp.—Identification, status, and habits.

JOHNSTON, DAVID W. 1953. Wintering Palm Warbler at Berkeley, California. Condor, **55**: 276–277.—*Dendroica palmarum palmarum* taken January 23, 1953.

JOUANIN, CHRISTIAN. 1953. Note sur la *Sterna fuscata* L. en Polynésie française. L'Oiseau, **23**: 149–150.—Report on and list of the colonies in the Tuamotus and Marquesas.

JUDD, W. W. 1951. *Lynchia americana* (Leach) (Diptera: Hippoboscidae) from a Great Horned Owl at St. Thomas, Ontario. Can. Field-Nat., **65** (5): 187.

KIEFFER, C. 1953. Quelques observations sur le *Picathartes oreas* Reichenow. L'Oiseau, **23**: 142–144.—Observations chiefly on nesting habits in Cameroon.

KIRKPATRICK, C. M., and A. C. LEOPOLD. 1953. [Comments and Communications section. Comments on communication by John Hammond, Jr. under title "Photoperiodicity in Animals: The Role of Darkness"]. Science, **117** (3041): 390–391, 1 table.

KIRKPATRICK, CHARLES M., and A. CARL LEOPOLD. 1952. The Role of Darkness in Sexual Activity of the Quail. Science, **116** (3011): 280–281, 1 fig., 1 table.—Experiment showed that 10 hours of light including a night interruption resulted in full sexual activity in both sexes whereas the same light ration given without interruption did not. J. C. Howell.

KROG, JOHN. 1953. Notes on the birds of Amchitka Island, Alaska. Condor, **55**: 299–304.—Includes observations on the breeding birds and data on the food of the Bald Eagle.

LACK, DAVID. 1953. Darwin's Finches. Scientific American, **188** (4): 66–72, 4 figs.—"In 1835 a group of small, unimpressive birds in a Pacific archipelago stimulated Charles Darwin's speculations on the origin of species. Today the birds are studied anew as an example of how species originate."

LANDAUER, WALTER. 1953. Genetic and Environmental Factors in the Teratogenic Effects of Boric Acid on Chicken Embryos. Genetics, **38** (3): 216–228, 7 tables.

LARSON, STEN. 1953. Gypaëte en Corse. Alauda, **21**: 134.—*Gypaetus barbatus* observed on Corsica on January 28.

LAWRENCE, LOUISE DE KIRILINE. 1952. New sight records of three species at Pimisi Bay, Ontario. Can. Field-Nat., **66** (2): 67–68.—Yellow-billed Cuckoo, Virginia Rail, Connecticut Warbler.

LAWRENCE, LOUISE DE KIRILINE. 1953. Nesting life and behavior of the Red-eyed Vireo. Can. Field-Nat., **67** (2): 47–77, 10 tables, 1 map.—A detailed and painstaking study conducted over a period of years on a 16-acre plot in central Ontario, east of North Bay. Subjects dealt with: the land, arrival in spring, territories, pre-nesting activities, the nests, the building of the nest, the egg-laying, incubation, development of the young, defense behavior, re-nesting and

nesting success, feeding habits, voice, departure from nesting grounds. Statistical treatment of such matters as singing, incubation, brooding data, feeding young. Particularly interesting study of various song patterns and their implications. A first-class behavior study of the species, carried out in the Nice tradition, with a number of new approaches and a wealth of findings that should give useful leads to those working on life-history or behavior projects.—W. W. H. Gunn.

LEBEURIER, E. 1953. Le Corbeau freux (*Corvus f. frugilegus*) dans le Finistère. L'Oiseau, **23:** 171–211, figs. 1–12. A study continued over a period of 30 years of the rookeries in extreme northwestern France. These rookeries are quite isolated from the other French populations and although quite persecuted and faced by a progressive destruction of their habitat due to increasing deforestation are, apparently, maintaining themselves.—C. Vaurie.

LIPPENS, L. 1953. Une invasion de Pétrels Cul-blancs (*Oceanodroma leucorhoa*) en Belgique. Gerfaut, **43** (2–3): 165–168.

MACKWORTH-PRAED, C. W., and C. H. B. GRANT. 1953. On the status of *Pternistis cooperi* Roberts . . . . Ostrich, **24:** 123. They believe it a dark individual of *P. cranchii swynnertoni*.

MANNING, T. H. 1952. Birds of the west James Bay and southern Hudson Bay coasts. Nat. Mus. Canada Bull. **125**, 114 pp., 7 pls.

MANNING, T. H., and D. F. COATES. 1952. Notes on the Birds of Some James Bay Islands. Bull. 126, Annual Rept. Natl. Mus. Canada, 1950–1951: 195–207.—Annotated list of 30 species.

MANNING, T. H. and A. H. MACPHERSON. 1952. Birds of the east James Bay coast between Long Point and Cape Jones. Can. Field-Nat., **66** (1): 1–35, 29 tables, 8 photographs, 1 map.—Based on observations and collections (498 birds) made between June 26 and September 2, 1950, at two major and numerous minor collecting stations along the coastline from the region of Old Factory River to the northeastern extremity of James Bay. Outlines previous ornithological work done in the region and gives physical and ecological descriptions both of the general area and the immediate vicinity of the locations visited. A careful record of the number of hours spent in observation at each location, sub-divided by habitat. The catalogue of birds observed includes reference to previous records and specimens, deals with 104 species, lists specimens collected, discusses subspecific characters and preferred habitat. Tables on population densities of commoner species. An example of the authors' ability to make the most of a collecting trip by the inclusion of modern observing techniques to provide a quantitative indication of population density and ecological background.—W. W. H. Gunn.

MARTIN, N. D. 1952. Fraser's observations of screech owls at a nest-box. Can. Field-Nat., **66** (3): 81–82, 1 fig.—Notes on behavior of a pair nesting in a box on the side of a house.

MAYR, ERNST. 1952. German experiments on orientation of migrating birds. Biol. Reviews, **27:** 394–400.—A review of work by Drost, Schüz, and others.

MCLEOD, J. A., and G. F. BONDAR. 1953. A brief study of the Double-crested Cormorant on Lake Winnipegosis. Can. Field-Nat., **67** (1): 1–11, 2 tables, 3 figs.—Investigation during 5 summers in period 1943–1951. Estimated 39,448 birds present in 1945. Large fish consumption comprises 7.2 per cent commercial species. At present population level, fish predation problem less acute than formerly but still requires attention. Chemical solution used gave not more than 50 per cent efficiency in destroying eggs.

MEWALT, L. R., and DONALD S. FARNER. 1953. The composition of a wintering population of White-crowned Sparrows in southeastern Washington. Condor.

55: 313–314.—Significantly more males than females found in winter; in the Snake River Canyon the data suggest a greater tendency for adult rather than first-year birds to winter in the area.

MILBOURN, L. W. H. 1952. Snipe at sea. Can. Field-Nat., **66** (4): 113.—*Capella* sp. aboard eastbound ship 1,000 miles east of Newfoundland, May 4, 1951.

MILLER, LOYE. 1953. California's first fossil bird. Pacific Discovery, **6** (4): 18–21.—An account of *Mancalla californiensis*.

MISONE, X. 1953. Les Grand Quartiers d'hiver du Sud-est de la Mer Caspienne. Gerfaut, 43 (2–3): 103–127, pls. 1–4, and 4 figs.—Observations on the wintering quarters of birds on the southern part of the Caspian Sea. This region is one of the richest in the world, and it is not unusual for several millions of winter visitors to be observed, these visitors coming from the Urals, Siberia, and Turkestan. Peregrine falcons and three species of eagles are abundant, as well as several hundred thousands of geese, ducks and thousands of flamingo.—C. Vaurie.

MONTGOMERY, K. C. and ERIC G. HEINEMANN. 1952. Concerning the Ability of Homing Pigeons to Discriminate Patterns of Polarized Light. Science, **116** (3017): 454–456, 2 tables. It is concluded (a) that if homing pigeons can discriminate at all among patterns of polarized light, they can do so only with extreme difficulty, and (b) that it is highly unlikely that homing pigeons make use of patterns of polarized sky light as cues in their homing flights. J. C. Howell.

MONTGOMERY, VESTER. 1953. The Leconte Sparrow in New Mexico. Condor, 55: 277.

MOREJOHN, G. VICTOR. 1953. A Gene for Yellowish-White Down in the Red Jungle Fowl. Journ. Heredity, **44** (2): 47–53, 3 figs.

MORRIS, DAVID M. 1953. Adrenal Hypertrophy in the White Leghorn Cockerel after Treatment with Thiouracil and Thyroidectomy. Science, **117** (3029): 61–62, 2 tables.

MUSACCHIA, X. J. 1953. A study of the lipids in Arctic migratory birds. Condor, **55:** 305–312.—Values for fatty acids, lipid phosphorus, cholesterol, and cholesterol esters in liver and kidney of *Clangula hyemalis*, *Pluvialis dominica*, *Phalaropus fulicarius*, and *Erolia alpina*.

NICE, MARGARET M. 1953. The earliest mention of territory. Condor, **55:** 316–317.

NICHOLS, J. T. 1953. Shorebird Memories. Birds of Long Island, **7:** 169–221.—These reminiscences include many original and interesting observations on the shorebirds of Long Island.

OLIVIER, GEORGES. 1953. Nidification du Faucon pèlerin sur les édifices. L'Oiseau, **23:** 109–124, pls. 10–12.

PARKES, KENNETH C. 1952. Wayne's Long-billed Marsh Wren in New Brunswick. Can. Field-Nat., **66:** (6): 173–174.—A rare species in New Brunswick, but a breeding colony recently discovered. Breeding birds are referred to *Telmatodytes palustris dissaëptus* Bangs, but two October (1895, 1930) specimens are referred to *T. p. waynei*, the breeding form of the coast of North Carolina.

PARKES, KENNETH C. 1953. Evidence for the suppression of the American race of the pintail. Condor, **55:** 275–276.

PARLAMAN, ROBERT D. 1953. Pileated Problem. Penna. Game News, **24** (9): 45–46, 2 figs.—Damage by Pileated Woodpeckers (*Dryocopus pileatus*) to wooden electric light poles in rural areas in northwestern Pennsylvania reported to total thousands of dollars.

PAULUSEN, W. 1953. Note sur le nombre de couvées du ramier (*Columba palumbus*) et du colombin (*C. oenas*). Gerfaut, **43** (2–3): 128–131.—In Flemish with French résumé.

PEARSON, OLIVER P. 1953. The Metabolism of Humming Birds. Scientific American, **188** (1): 69–72, 3 figs.—"During the day this smallest of the warm-blooded animals consumes energy at a terrific rate, and spends most of its time eating. Unable to feed itself at night, it must go into deep 'hibernation' to avoid starving."

PETERS, HAROLD S., and THOMAS D. BURLEIGH. 1951. Birds of the St. Pierre and Miquelon Islands. Can. Field-Nat., **65** (5): 170–172.—Recorded during a four-day visit July 19–22, 1945.

PHELPS, WILLIAM H., and WILLIAM H. PHELPS, JR. Eight new birds and thirty-three extensions of ranges to Venezuela. Proc. Biol. Soc. Wash., **66**: 125–146. *Otus albo-griseus obscurus* (Cerro Pojochaina), *Dendrocincla homochroa meridionalis* (Burgua), *Pachyramphus albogriseus coronatus* (Cerro Tamuypejocha), *Diglossa barbitula coelestis* (Barranquilla), *Basileuterus tristriatus perijanus* (Cerro Pejochaina), *Thlypopsis fulviceps obscuriceps* (Cerro Pejochaina), *Hemisphingus* [sic] *frontalis flavidorsalis* (Cerro Jurustaca), and *Catamblyrhynchus diadema federalis* (E. Junquito), new subspecies.

PHILLIPS, H. J., and I. L. WILLIAMS. 1953. The Oxidation of Chicken Fat Tissue. Science, **117** (3050): 658–659, 2 figs.

PINCHON, R. 1953. Apercu sur l'avifaune de la Désirade. L'Oiseau, **23**: 161–170, pl. 13. This small island which measures 11 by 2 to 2.5 kms. and is only 12 km. from Guadeloupe has a relatively rich avifauna which is little disturbed and, as a result, denser than in the neighboring island.—C. Vaurie.

POLUNIN, NICHOLAS, and CARL R. EKLUND. 1953. Notes on food habits of waterfowl in the interior of Ungava Peninsula. Can. Field-Nat., **67** (3): 134–137.—Based on analysis of stomach contents of 4 Ungava Canada Geese, one Old-squaw Duck and one Black Duck. Aquatic plants lacking in area. Geese had consumed mainly monocotyledonous plants—*Carex* spp., *Juncus* spp., *Poa arctica; Equisetum arvense* also important in bulk. Sedgy marshes suggested as feeding areas.

PRESTON, F. W., and E. J. PRESTON. 1953. Variation of the shapes of birds' eggs within the clutch. Ann. Carnegie Mus., **33**: 129–139.—Precise study of 20 sets of eggs of the Laughing Gull (*Larus atricilla*); the last egg of the clutch differs significantly in form from the earlier eggs.

PUTMAN, WM. L. 1952. Bird migration along the Lake Ontario Shore of the Niagara Peninsula. Can. Field-Nat., **66** (2): 39–44.—Waterfowl migration is along the shore, westward in spring, eastward in fall, fall migration less conspicuous. Hawks migrate westward parallel to shore in spring, but the autumn migration misses this district. Some other land birds follow same route in spring.

RICHMOND, STANLEY M. 1953. The attraction of Purple Martins to an urban location in western Oregon. Condor, **55**: 225–249.—Includes an interesting account of raising young martins by hand, information on the ecological requirements of martins in the wild, and the apparent need for extra calcium in the diet in regions in which there may be insufficient calcium in the soil.

RIPLEY, S. DILLON. 1953. Notes sur les oiseaux du Laos. L'Oiseau, **23**: 89–92.—A few notes on the David-Beaulieu collection. About half of this collection was destroyed in the war in Indochina, and the remainder is now in the Peabody Museum at Yale University. *Spizaëtus nipalensis nipalensis*, new for the Indo-

china list. *Paradoxornis verreauxi beaulieui*, and *Yuhina flavicollis constantiae*, both from Phou Kobo, Laos, new subspecies.

ROBERTS, E., W. E. SHAKLEE, and H. F. FALLS. 1952. A Red-eye Mutation in White Plymouth Rocks. Journ. Heredity, **43** (5): 201–204, 3 figs.

RUWET, J.-C. 1953. Notes sur l'ouverture des bouteilles de lait par les Mésanges bleues (*Parus c. caeruleus*) et charbonnières (*Parus m. major*). Gerfaut, **43** (2–3): 168–171.—Belgian tits do not open milk bottles for such bottles are not left outdoors in Belgium and are closed by mechanical or metallic caps, but a series of tests show that they learn to open bottles stopped with cardboard in a few days and show initiative, adaptation, and visual imitation, *P. caeruleus* learning the more quickly.—C. Vaurie.

SAEZ-ROYUELA, RAMON. 1953. Liste des Passeriformes de l'Espagne (Ire. partie). L'Oiseau, **23**: 93–108.—First installment of a list of the birds of continental Spain compiled from the works of various authors. Brief statements of range are given and recoveries of banded birds are cited. The author, unfortunately, accepts uncritically a number of forms the validity of which has been questioned or rejected.—C. Vaurie.

SALOMONSEN, FINN. 1952. Systematic Notes on some Philippine Birds. Vidensk. Medd. fra Dansk naturh. Foren., **114**: 341–364, 1 pl.—*Tanygnathus lucionensis hybridus* (Polillo), *Chrysocolaptes lucidus montium* (Luzon), *Orthotomus atrogularis davao* (Mindanao), *Cinnyris sperata manueli* (Polillo), *Cinnyris sperata minima* (Mindanao), *Rhabdornis longirostris* (Luzon), *Sarcops calvus similis* (Negros), *Sarcops calvus samarensis* (Samar), and *Sarcops calvus minor* (Mindanao) described as new.

SALT, GEORGE WILLIAM. 1953. An ecologic analysis of three California avifaunas. Condor, **55**: 258–273.—The avifaunas of three California localities were classified on the basis of location of the feeding site within the strata of the vegetation and the type of food taken. Yearly changes in the bird life of these localities were diagramed according to this system. Differences in the structure and proportions of the avifaunas of these localities presumably reflect differences in vegetation structure and climate.

SHAKLEE, WILLIAM E., and C. S. SHAFFNER. 1952. High and Low Thyroidal Response to the Feeding of Thiouracil to New Hampshire Chickens. Journ. Heredity, **43** (5): 238–242, 3 figs.

SHAVER, WILLIAM E. 1953. Owl obit. Penna. Game News, **24** (9): 36.—Great Horned Owl (*Bubo virginianus*) descended chimney after "swallows," presumably Chimney Swifts.

SHEPPARD, R. W. 1952. The Black Tern as an insect-eater. Can. Field-Nat., **66** (5): 129.

SHULTZ, FRED T., and W. E. BRILES. 1953. Adaptive Value of Blood Group Genes in Chickens. Genetics, **38** (1): 34–50.

SIBLEY, CHARLES G. 1953. Forster Terns breeding on San Francisco Bay. California. Condor, **55**: 278–279.

SKEAD, C. J. 1953. A study of the Spectacled Weaver (*Ploceus ocularius* Smith). Ostrich, **24**: 103–110.—Life history.

SLADEN, W. J. L. 1953. The Adelie Penguin. Nature, **171**: 952–955.—A summary of the breeding routine.

SMITH, W. JOHN. 1952. Summer observations of the evening grosbeak in southern Ontario and Quebec. Can. Field-Nat., **66** (3): 89.—Summer of 1951.

SNYDER, L. L. 1950. A classification of Ontario Birds. Misc. Pub. Roy. Ont. Mus. Zool., No. 3, 1–11.—Classification from Class to Species, covering all species

credited to the province on the basis of one or more collected specimens. Primarily for teaching purposes, a useful reference.

SNYDER, L. L. 1953. On eastern *Empidonaces* with particular reference to variation in *E. traillii*. Contr. Roy. Ont. Mus. Zool. and Pal., No. 35, 1–26, 2 tables, 4 figs.—Differences between the 3 eastern species of *Empidonax* are summarized and their close similarities emphasized; non-morphological differences are more striking than the morphological ones, which are largely a matter of degree, but their specific rank is unquestioned. Geographic variation in *E. traillii* is then considered. Western populations may be divided from eastern and northern populations, on basis of tenth primary being shorter than fifth (map, fig. 2). On slight morphological differences, but more constant and more pronounced differences with respect to type of nest and songs, eastern populations may be divided into two races, one occupying the area from northeastern United States across Canada to Alaska (greener dorsal surface, more yellow pigment on ventral surface, "phe-be-o" song, untidy nest, damp habitat), the other ranging from the great plains of the United States eastward to New York (browner dorsal surface, whiter on ventral surface, "fitz-bew" song, neat felted nest, dryer habitat). Author disagrees with Aldrich's premise that population in middle south need be provided with a new name and considers it most reasonable to retain the name *E. t. traillii* (Audubon) for the southern race, and to apply *E. t. alnorum* Brewster to the northern race ranging from northeastern United States to Alaska.—W. W. H. Gunn.

SNYDER, L. L., and H. G. LUMSDEN. 1951. Variation in *Anas cyanoptera*. Occ. Pap. Roy. Ont. Mus. Zool. No. 10, 1–18, 2 tables, 3 figs.—A comparative survey of the Cinnamon Teal of the two Americas, based on study of 144 specimens. Certain morphological differences are correlated with geographic and ecological zones. Differences extend to characteristics of a physiological and conditioned nature. A plumage in the sequence of the developing male is common to South American but omitted in North American populations. Phylogeny of "eclipse" plumage discussed. Five races of the species are recognized, three of which are newly described. The nominate race is restricted to southern South America, and the name *Anas cyanoptera septentrionalium* is proposed for the birds of the whole North American segment of range. The large form (Peru, Chile) *A. c. orinomus* (Oberholser) is recognized; the other two races, *A. c. borreroi* and *A. c. tropicus*, are from Colombia.—W. W. H. Gunn.

SPAEPEN, J. 1953. La migration du Pipit des arbres (*Anthus trivialis*) en Europe et en Afrique. Gerfaut, **43** (2–3): 178–228, figs. 1–6.—In Flemish with a French résumé which, unfortunately, is inadequate in view of the length of the article and its wealth of documentation.—C. Vaurie.

STIRRETT, GEORGE M. 1952. Rough-legged hawk migration in James Bay area. Can. Field-Nat., **66** (3): 87.—Southwestward movement, October 15–16, 1949.

STIRRETT, GEORGE M. 1952. Lawrence's Warbler in Canada. Can. Field-Nat., **66** (4): 11.—Two sight records, one north of Kingston, Ont., in June, 1947 (plumage and song described), one near Toronto, May, 1951.

STULLKEN, DONALD E., and WILLIAM A. HIESTAND. An experimental study of the influence of pelage pigmentation on metabolic rate and its possible relationship to body temperature control and ecological distribution. Ecology **34** (3), 1953: 610–613.—Oxygen consumption of albino mice whose hair was dyed black and natural black mice was increased more rapidly by a drop in air temperature than in non-dyed albino controls. This indicates that white coloration in northern

animals during the winter may be advantageous in conserving body heat as well as acting as concealing coloration.

SUTTON, GEORGE MIKSCH. 1953. The Brown-crested Flycatcher in the Florida Keys. Condor, **55:** 274–275.—*Myiarchus tyrannulus nelsoni* collected at Big Pine Key, January 1, 1953.

TAIBEL, ALULAH M. 1953. Osservazioni sulla riproduzione e allevamento in cattivitá di *Penelope superciliaris superciliaris* Temminck e *Ortalis garrula garrula* (Humboldt). Riv. Ital. Ornit. **23:** 85–122, 24 figs.

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NOTES AND NEWS

The seventy-second stated meeting of the A.O.U. is to be held September 8 to 12, 1954, at Madison, Wisconsin, under the sponsorship of the University of Wisconsin. Dr. A. W. Schorger is Chairman of the Local Committee on Arrangements. We hope that the early date of the meeting will make it possible for many students to attend.

The attractively illustrated circular of information on the A.O.U. has been revised. Anyone who is interested in joining the Union or who wishes to send this circular to potential members may obtain copies from the Secretary, the Treasurer, or the Committee on the Nomination of Members.

It is with regret that we report the death of two Fellows of the Union: Francis Henry Allen, on October 24, 1953, and Mrs. Walter W. Naumburg, on November 25, 1953.

The Eleventh International Ornithological Congress will meet May 29 to June 5, 1954, in Basel, Switzerland. Excursions have been planned for both before and after the Congress. We have a supply of brochures giving information on the Congress and the field trips and including a registration form and an application to present a paper. These forms must be sent to the Congress Office by February 28 at the latest. Those interested in attending may obtain a copy of this announcement by writing the Editor (Robert W. Storer, University of Michigan Museum of Zoology, Ann Arbor, Michigan).

The Cooper Ornithological Society will hold its next annual meeting at Tucson, Arizona, April 22 to 24, 1954. This will be the first meeting of a major ornithological society in the Southwest, and members of the A.O.U. who attend will be assured not only of a good meeting but also a chance to see many of the interesting birds of this region. The sponsors of the meeting are the University of Arizona, the Tucson Natural History Society, and the Tucson Audubon Society; Allan R. Phillips is Chairman of the Local Committee.

Mr. Richard A. Sloss of 65 Brower Avenue, Woodmere, New York, is gathering data on the spread of the Cattle Egret in North America. The importance of collecting and recording as much material as possible while this species is expanding its range should be clear to all observers, and we hope that as many as can will send Mr. Sloss information on this bird.

This issue of 'The Auk' contains one of two reports of the American Ornithologists' Union Committee on Bird Protection. Limitation of space requires postponement of the second report that deals in excellent fashion with needs and problems in this field. This report will appear in a later number.

May I take this occasion to reiterate the deep concern of the Council and of myself in matters of conservation and to invite members of the Union who are likewise interested to address me or the Committee on matters of bird protection.—Alden H. Miller, *President.*

SPECIAL REPORT AND PROPOSALS REGARDING CONSERVATION ACTIVITIES OF THE AMERICAN ORNITHOLOGISTS' UNION

Since its organization the American Ornithologists' Union has made its work the advancement of its members in ornithological science and the publication of a journal of ornithology and other works relating to that science.

The Union has confined itself to these objectives, and it will be noted that bird protection is not in itself one of the aims for which the organization was founded. Nevertheless, as would be expected, its members, and at times the organization, have taken a keen interest in bird protection.

At the second meeting of the A.O.U., a committee was formed to work for the protection of North American birds and their eggs against wanton and indiscriminate destruction. This committee was instrumental in founding the National Audubon Society, and later some of the activities of the Committee were taken over by the U. S. Biological Survey when that government organization was formed in 1885. Thus, from an historical standpoint, the Union has had a considerable, and at times, powerful, influence in the cause of wildlife conservation, particularly the conservation of birds.

The Union has had continuously a bird protection committee similar to the original ones, the principal function of which has been to provide information regarding conservation activities or problems to the members of the organization.

From time to time efforts to interest the Union in specific projects have been made. In this connection, the Union has neither a paid staff nor facilities for acquiring information that would make it possible for it to participate intelligently and in detail in the many conservation problems that exist. Its officers now give generously of their time to manage its affairs, and it would be impossible for them to give the additional time that a conservation program would require.

The Union is an international organization with members in Canada, the United States, and elsewhere, and for that reason it would be unwise for it to act on conservation problems which concern one government. The Union properly can consider major conservation problems as coming within its field of interest, but the very fact that it is international in its membership makes it a practical necessity to act only on fundamental problems with international implications.

The Union has, however, an important indirect role in conservation matters. Many of its members are also members of conservation groups and support local as well as national and international organizations in that field. For some this has been their life work. In addition, most of the members are centers of local influence for spreading knowledge of birds and bird protection in their home areas. Many of the members serve as scouts or lookouts for conservation organizations when local or other problems become acute enough to demand concerted attention. The Union also provides the greatest body of scientific knowledge about birds of the Americas that is available, and its members have freely placed their knowledge at the disposal of most, if not all, organized conservation groups.

It is the belief of this committee that we have thus achieved a major conservation force which is difficult to measure and yet is contributing daily both to education and to the programs of action groups working for better protection and management not only of birds but all forms of wildlife and their habitat.

It is our recommendation that the following be considered as the guiding principles of the American Ornithologists' Union in dealing with conservation problems.

1. That the A.O.U. recognize that bird protection is only a part of the whole conservation problem; that the conservation of soil, water, and vegetation are fundamentally important for the preservation of birds; and, in fact, the preservation of suitable habitat in many cases far outranks in importance the protection of the birds themselves.
2. That the A.O.U. take no direct action in conservation matters but that it encourage its members to continue to supply information to conservation groups and to participate locally, nationally, and internationally in the organizations that are promoting the conservation of basic natural resources.
3. That the A.O.U. encourage its members to exert all possible effort to teach conservation and to encourage conservation thinking in their own communities.
4. That the A.O.U. maintain a committee on bird protection whose primary function shall be to provide to the members, at least annually, and more often if necessary, information on critical conservation problems in which participation by A.O.U. members is important. The Committee shall present a report outlining the progress or lack of progress in conservation during the preceding year.
5. That the work of conservation organizations be reviewed in this report and that this Committee be authorized to give official commendation to meritorious conservation efforts. Such commendations would not involve any commitment for the American Ornithologists' Union but would simply be a recognition by this organization of good work by other organizations primarily devoted to conservation problems.
6. That in establishing this policy, the Union should reserve the right to investigate and take a position on any fundamental problem with international implications.

IRA N. GABRIELSON, *Chairman*
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OBITUARIES

ALBERT ERNEST COLBURN, Honorary Life Associate of the A.O.U., was born in Washington, D. C., November 9, 1872, and passed away in Los Angeles, California, January 16, 1953.

His interest in natural history began when he was a boy in Virginia, where he enthusiastically collected birds' eggs and became acquainted with the habits of the birds themselves. At the Smithsonian Institution where he went as a teen-ager to do volunteer work, young Colburn met Frederick Webster and from him learned the art of fine taxidermy. Under Mr. Webster's influence, also, exciting new fields of interest opened to the lad as he investigated the habits of all the living creatures he could discover.

His facile handling of taxidermy work earned for him a good position in a taxidermy establishment in New York when he was barely twenty. He left this at the call of the Smithsonian to prepare the national exhibit of birds and mammals for the Chicago Fair, in 1893. With the Smithsonian, and later with Princeton University, Colburn made several scientific expeditions, travelling to Africa, Newfoundland, Mexico, and Central and South America.

Early in this century he came to Los Angeles and set up a taxidermy business of his own. Soon after this he was married to Annie Laurie Starke, an artist and designer. With his knowledge of animals and furs and her knowledge of design, it was not long before Colburn was persuaded to open a fur shop. During these early years in California, Colburn collected birds extensively in the Los Angeles area and joined the Cooper Ornithological Club. Several of his ornithological notes were published in the official journal of that society, The Condor.

In later years, when his business was well established, Colburn turned once more to the enjoyment of scientific expeditions. Two of his longest trips were made at this time—one to the Amazon River and another to the Galapagos Islands. Both were very lucrative of scientific specimens.

Mr. Colburn was one of the fortunate men able to combine business with pleasure. As he rose from taxidermist to the owner of one of the finest fur salons in the west, he never lost sight of the lessons to be learned and the enjoyment to be found in Nature. He will be remembered not only for his achievements but for his kindly philosophy of life which reflected his love and respect for the world of Nature.—HILDEGARDE HOWARD.

JOSEPH SCATTERGOOD DIXON, a Life Member of the American Ornithologists' Union, died June 23, 1952, after a long illness, at his home in Escondido, San Diego County, California at the age of 68. He was born March 5, 1884, near Galena, Cherokee County, Kansas, the son of Benjamin Franklin Dixon and a nephew of the late Joseph M. Dixon, a Senator from Montana and subsequently Assistant Secretary of the Interior. He moved with his parents to Escondido, California, and after graduation from the Escondido High School, entered Throop Polytechnic Institute at Pasadena. Here he met Joseph Grinnell and the two became fast friends for life. In 1910 he graduated from Stanford University. After the establishment of the Museum of Vertebrate Zoology at the University of California in Berkeley, he became a member of the staff and remained there for nearly 30 years.

He was elected an Associate of the Union in 1917 and a Member in 1931. He was also a member of the Cooper Ornithological Club, California Academy of Sciences, the Wildlife Society, and the American Society of Mammalogists.

Dixon was an active, careful, and accurate field worker and made many explorations in California and Alaska. Among his notable accomplishments in the field was

his discovery of the nest of the Surfbird in the Mount McKinley region during the Alexander Expedition to Alaska in 1907–08. In 1913–14 he was a member of the Harvard Expedition to Alaska and Siberia. Other field work included studies of the mammals of Sequoia National Park, the food habits of the Mule Deer in California, and ecological investigations of the Mount Lassen region. This last resulted in an elaborate publication in 1930 with Joseph Grinnell and J. M. Linsdale on the "Vertebrate Natural History of a Section of Northern California through the Lassen Park Region." He was also joint author with Grinnell and Linsdale of a comprehensive work on the "Fur Bearing Animals of California" and prepared an elaborate Wildlife Portfolio of the Western National Parks. For many years he was a member of the Wildlife Branch of the National Park Service, and for several years, beginning in 1931, he taught in the Yosemite School of Field Natural History.—T. S. PALMER.

LEON NELSON NICHOLS, an Associate of the American Ornithologists' Union, elected in 1917, died in New York City on August 3, 1953. He was born in Middleville, New York, on November 10, 1868. He graduated from Cornell University in 1892 and came to New York City in 1903 as librarian of the Astor Library, later consolidated with the Public Library. Up to the time of his retirement he was in the rare book department of this institution. Long service as deacon of the Broadway Tabernacle Congregational Church led to the preparation of a history of this church. His published writings ranged from genealogy, history, and early printing to natural history.

'Birds of America' (1917), edited by T. Gilbert Pearson, contains 50 articles written by Mr. Nichols, of which 28 are unsigned. He also provided the article on the birds of Long Island in Thompson's 'History of Long Island' (1918). Data were also furnished by him for Griscom's 'Birds of the New York City Region' (1923). He was a member of the Local Avifauna Committee of the Linnaean Society and belonged to the following organizations: National Audubon Society, Wilson Ornithological Club, Linnaean Society of New York, Quill and Dagger, and Bibliographical Society of America.—A. W. SCHORGER.

JOHN MCFARLANE PHILLIPS, a Life Associate of the American Ornithologists' Union, elected in 1920, died in Pittsburgh, Pennsylvania, September 8, 1953, at the advanced age of 92. He was born in Pittsburgh, February 15, 1861, the son of James and Anna (Provost) Phillips, graduated from the Pittsburgh High School in 1878, and continued his studies under private tutors. He began his business career as Assistant Manager of the mine and mill department of Oliver Bros. and Phillips and in 1885 was made Manager. In 1889 he was associated with his uncle in organizing the Phillips Mine Supply Co. of which he became president in 1906.

He was a member of the State Board of Game Commissioners from 1905 to 1924 and in later years served as its president. He was especially interested in establishing state game preserves near hunting areas and in planting these preserves with food for birds. With the aid of friends he secured the establishment of a large preserve for mountain goats along the British Columbia-Alberta boundary in Canada where he had hunted in former years. He was also interested in the Boy Scouts and organized the first troop in Pennsylvania, the second in the United States. He collaborated with Dr. W. T. Hornaday in the publication of 'Hunting in the Canadian Rockies' (1906) and 'Hunting on Desert and Lava' (1908). Phillips was Honorary President of the Pittsburgh Zoological Society, Honorary member of the Camp Fire Club of America, and member of the New York Zoological Society, the Lewis and Clark Big Game Club, the Boone and Crockett Club, and the Pittsburgh Chamber of Commerce.—T. S. PALMER.

RICHARD STUART PHILLIPS, *author and educator, lives in Findlay, Ohio, with his wife and two young children, Nancy and Thomas Stuart. He is the author of many articles that have appeared in Audubon Magazine, Nature Magazine, Field and Stream, and in many other conservation journals. He has also written a book,* Birds of Hancock County, Ohio. *His chief interest at present is in field work on the birds of Mexico.*

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ROBERT W. STORER, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

All persons interested in ornithology are invited to join the American Ornithologists' Union. Application may be made to the Treasurer; dues for Associates are $4.00 per year. 'The Auk' is sent without charge to all classes of members not in arrears for dues.

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